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For:	**METHOD AND DEVICE FOR THE PRODUCTION OF A CAN BODY AND CAN BODY**		

LETTER REQUESTING REPUBLICATION OF PATENT PUBLICATION PURSUANT TO 37 CFR 1.221(b)

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October 15, 2007

Dear Sir:

A material mistake on the part of the United States Patent and Trademark Office has resulted in the publication of the wrong title, abstract, specification, and drawings in connection with the above-identified publication, U.S. National Phase of PCT/CH04/000368. Republication of the Patent Publication is respectfully requested as this is a mistake which affects the public's ability to appreciate the technical disclosure of the patent application publication or determine the scope of the provisional rights that an applicant may seek to enforce upon issuance of a patent.

The Notice of Publication, mailed August 2, 2007, did list the correct title for the above-identified application. However, the Notice of Publication directs Applicant to a publication which publishes an abstract, specification, and drawings which are identical to the abstract, specification and drawings filed in connection with a different application, and not identical to the abstract, specification and drawings filed in connection with this application

(the abstract, specification, and drawings appear to be a copy of application serial number 10/502,939, which was previously published correctly as 2005/0218148, a copy of which is attached hereto). Copies of the correct application and drawings as filed in connection with the present application are attached hereto.

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Very truly yours,

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(54) **DOSING BODY WITH AN EXTERNAL BASE COVERING, METHOD AND DEVICE FOR APPLYING THE BASE COVERING**

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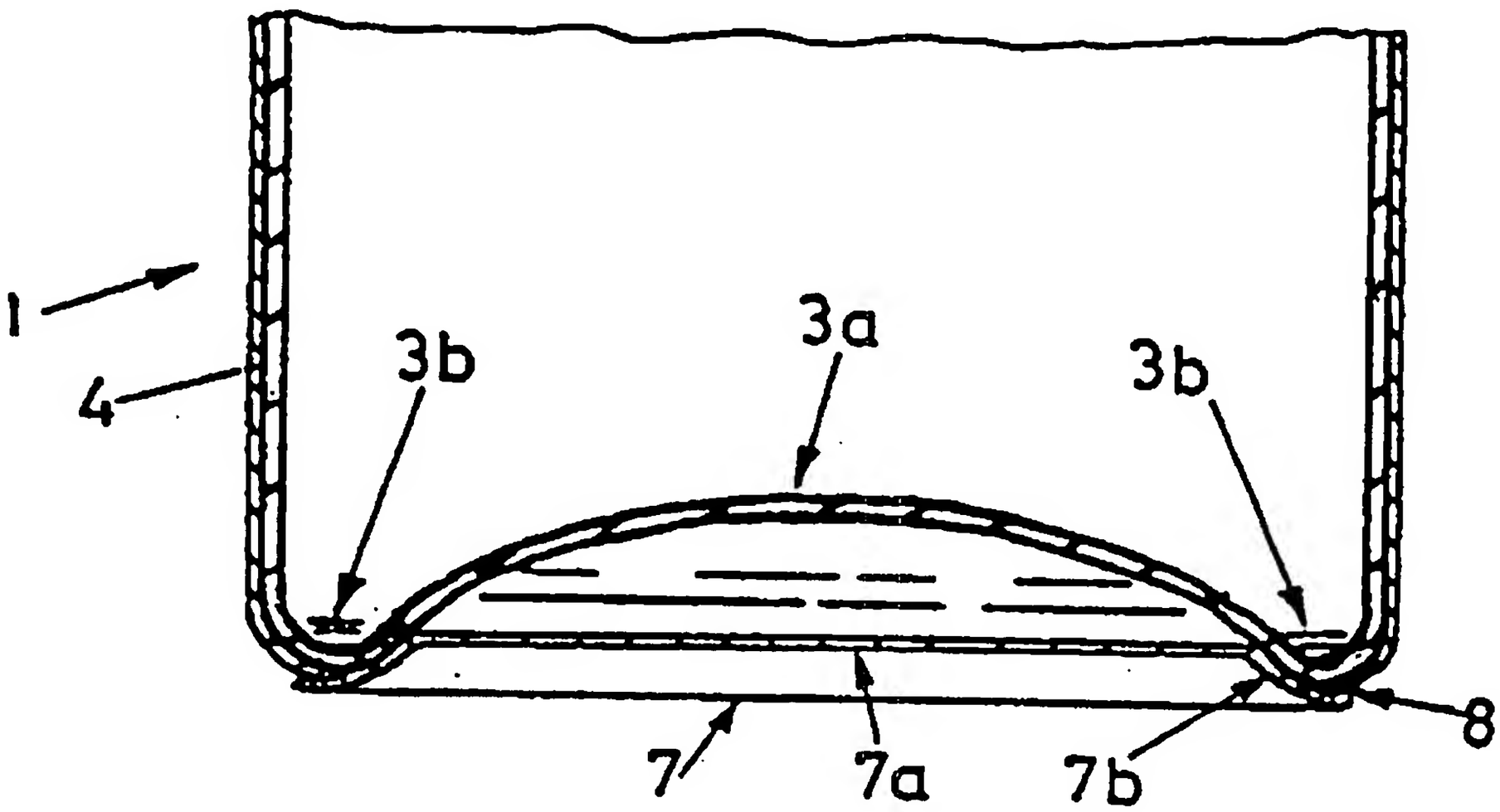
(57) **ABSTRACT**

A can body with a jacket-like closed wall and a base constructed on one end of the can wall includes an external base covering in the form of a sheet material. The base covering is fixed into position on an annular connection region of the can body. The base covering can form a basically flat imprintable region in a main region that is surrounded by the connection region. If a bar code can be applied in this imprintable region, then a restriction of the configuration possibility of the can wall disappears. The base covering can form a stand region whereby a standing can body is only in contact with the support surface if necessary via the base covering, and consequently the occurrence of corrosion problems is prevented. A retaining device that leaves the base of a held can body free and a position fixing apparatus are used for fixing the base covering into position. A decorative foil on the exterior of the can wall can be overlapped by the base covering, which serves to prevent a detachment of the decorative foil on the base.



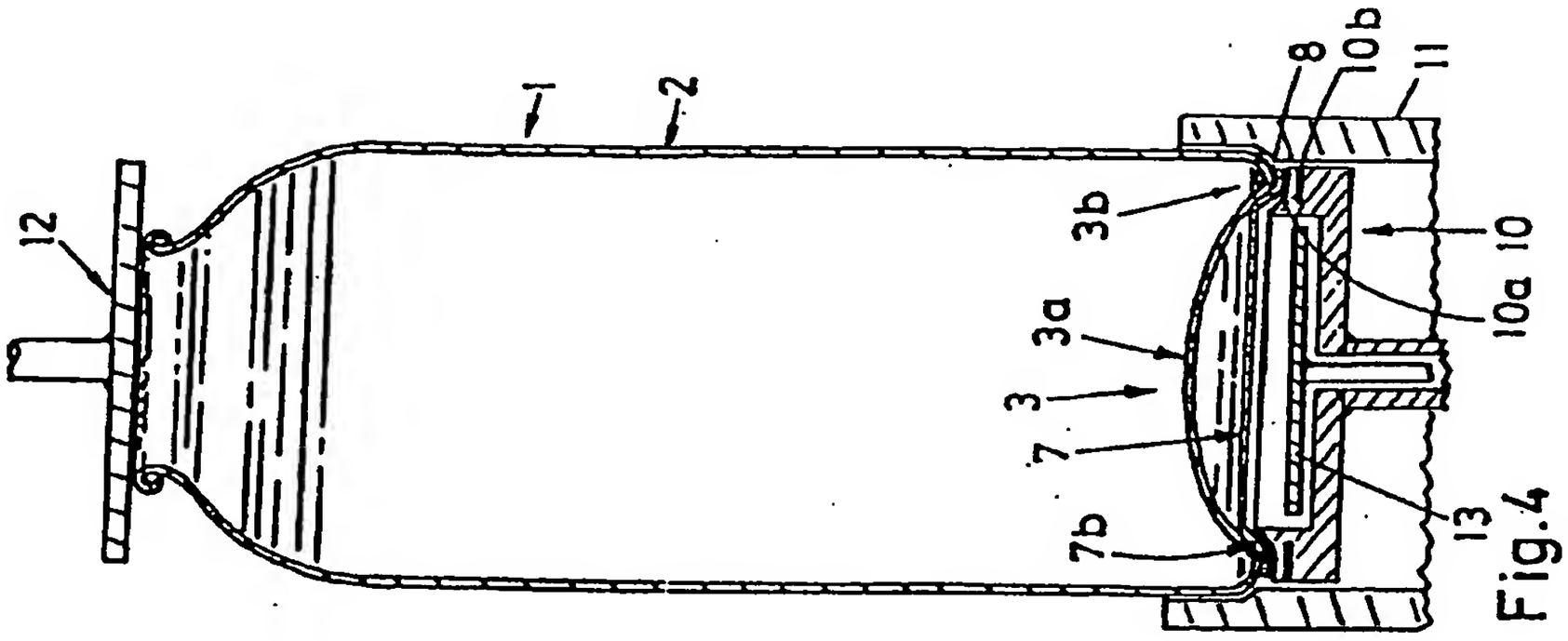


Fig.4

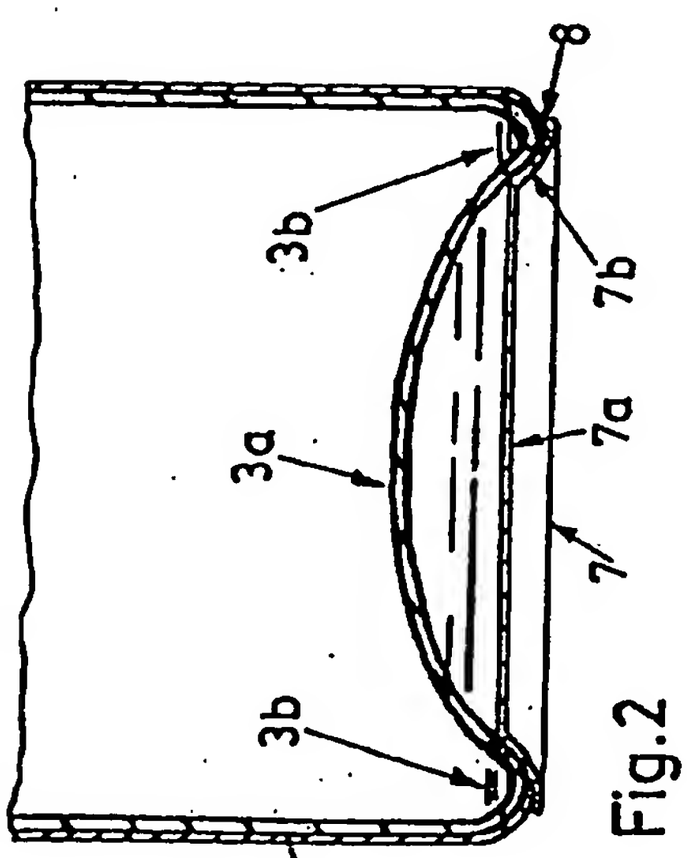


Fig.2

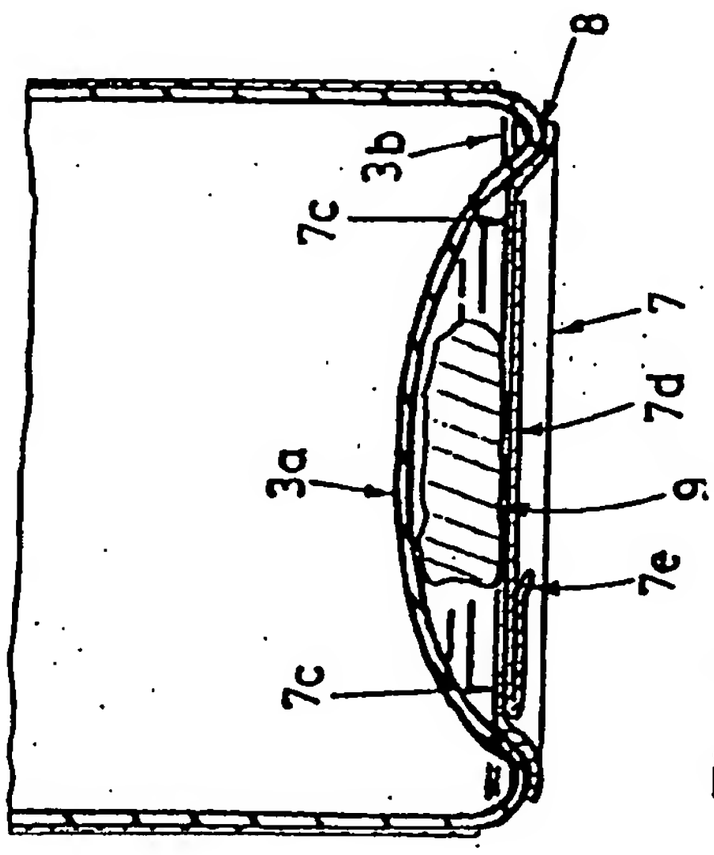


Fig.3

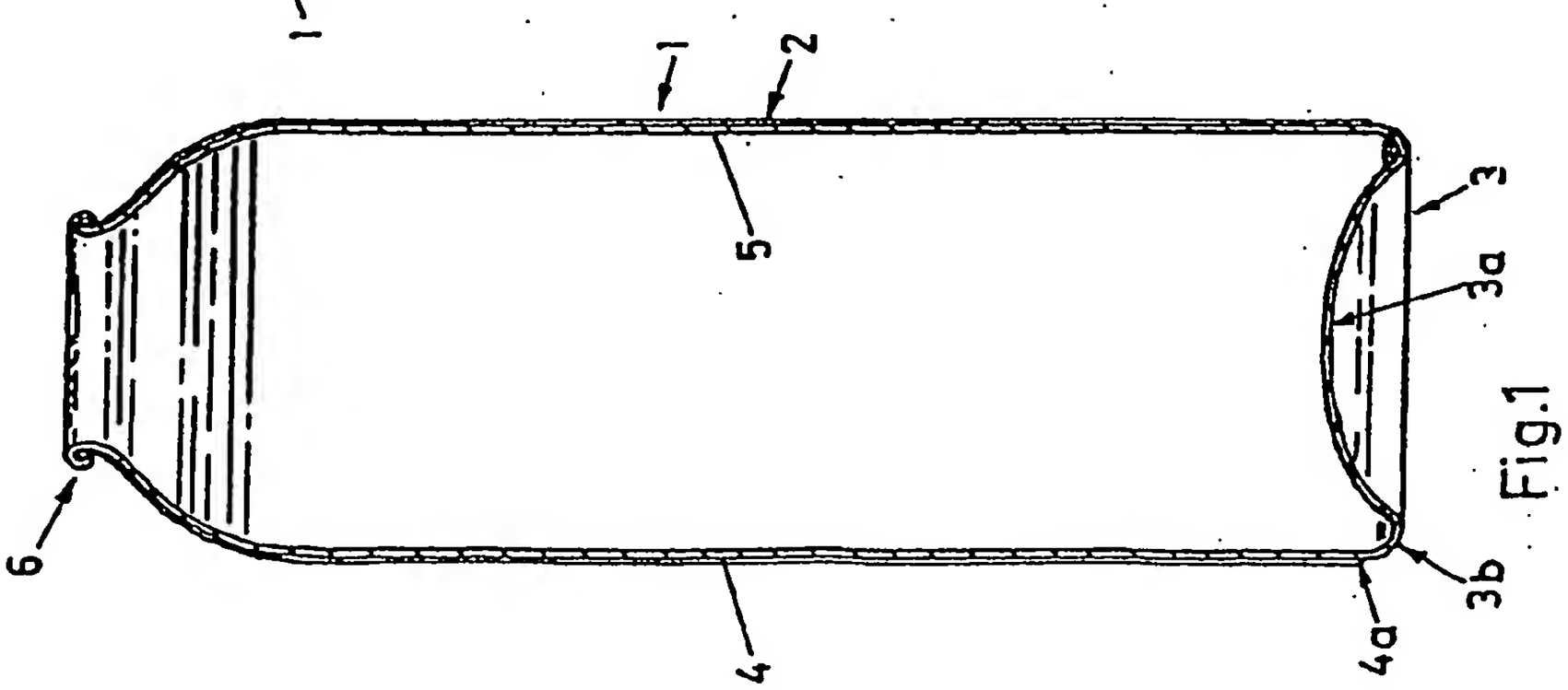


Fig.1

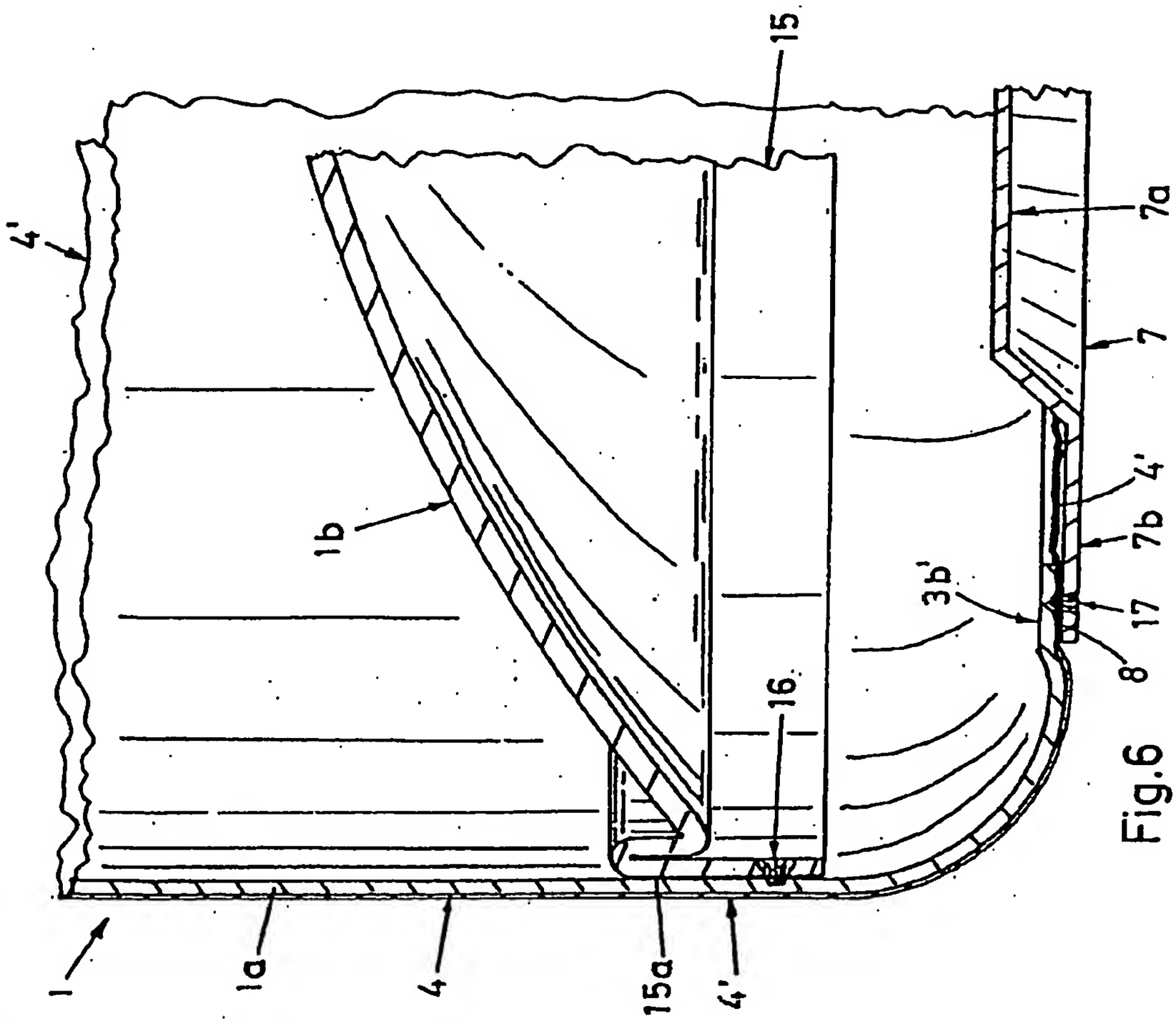


Fig.6

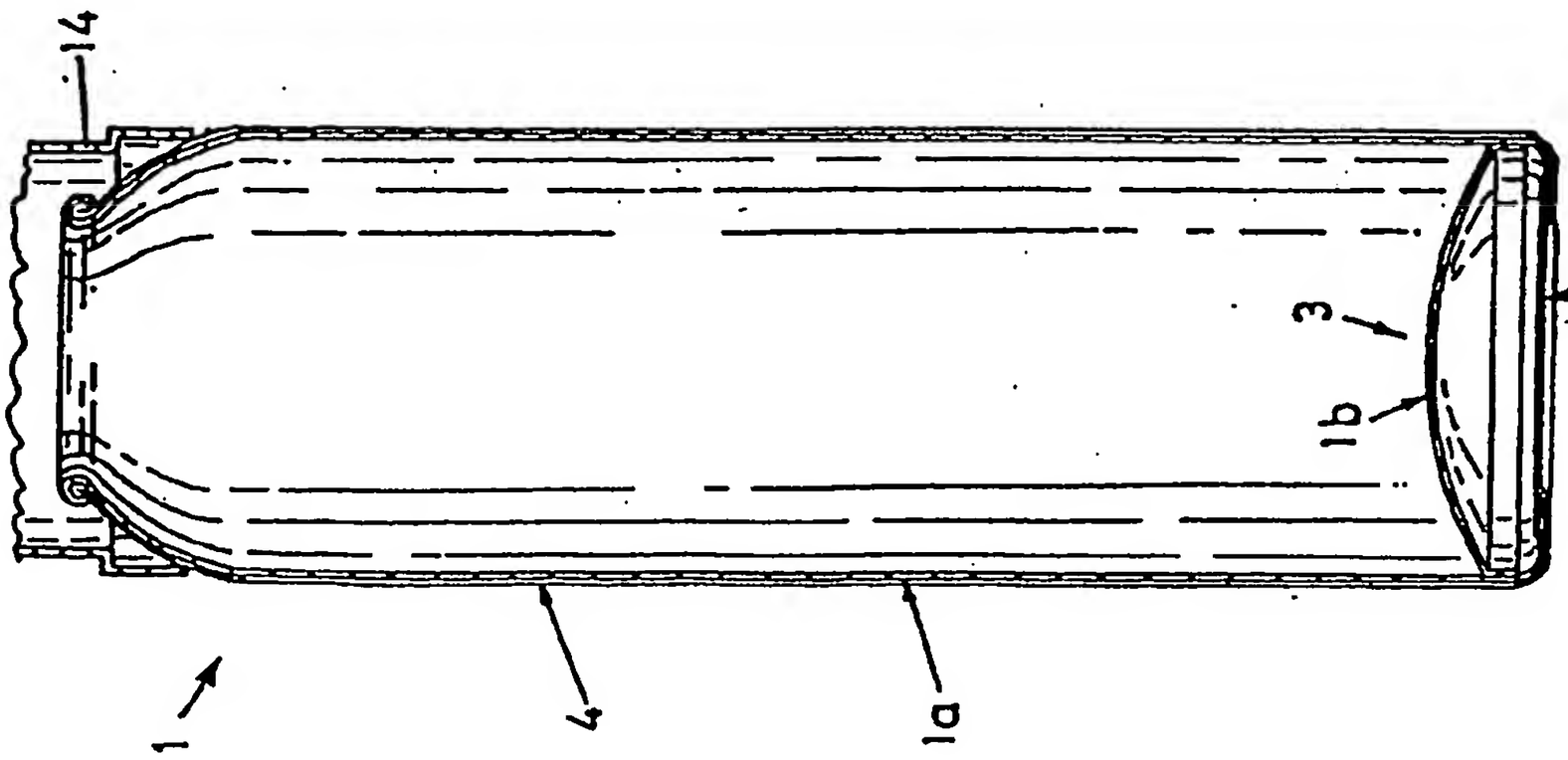


Fig.5

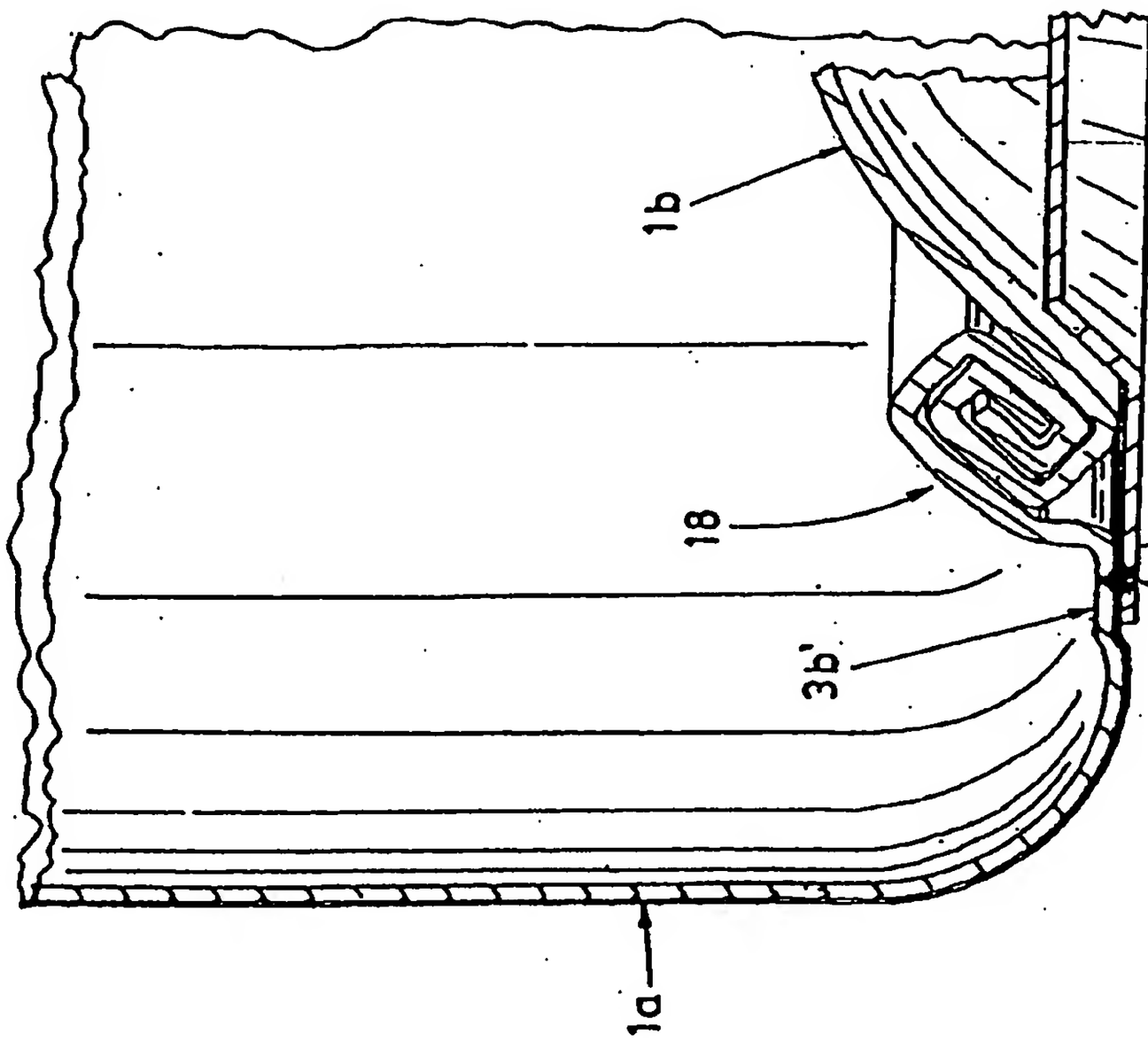


Fig.8

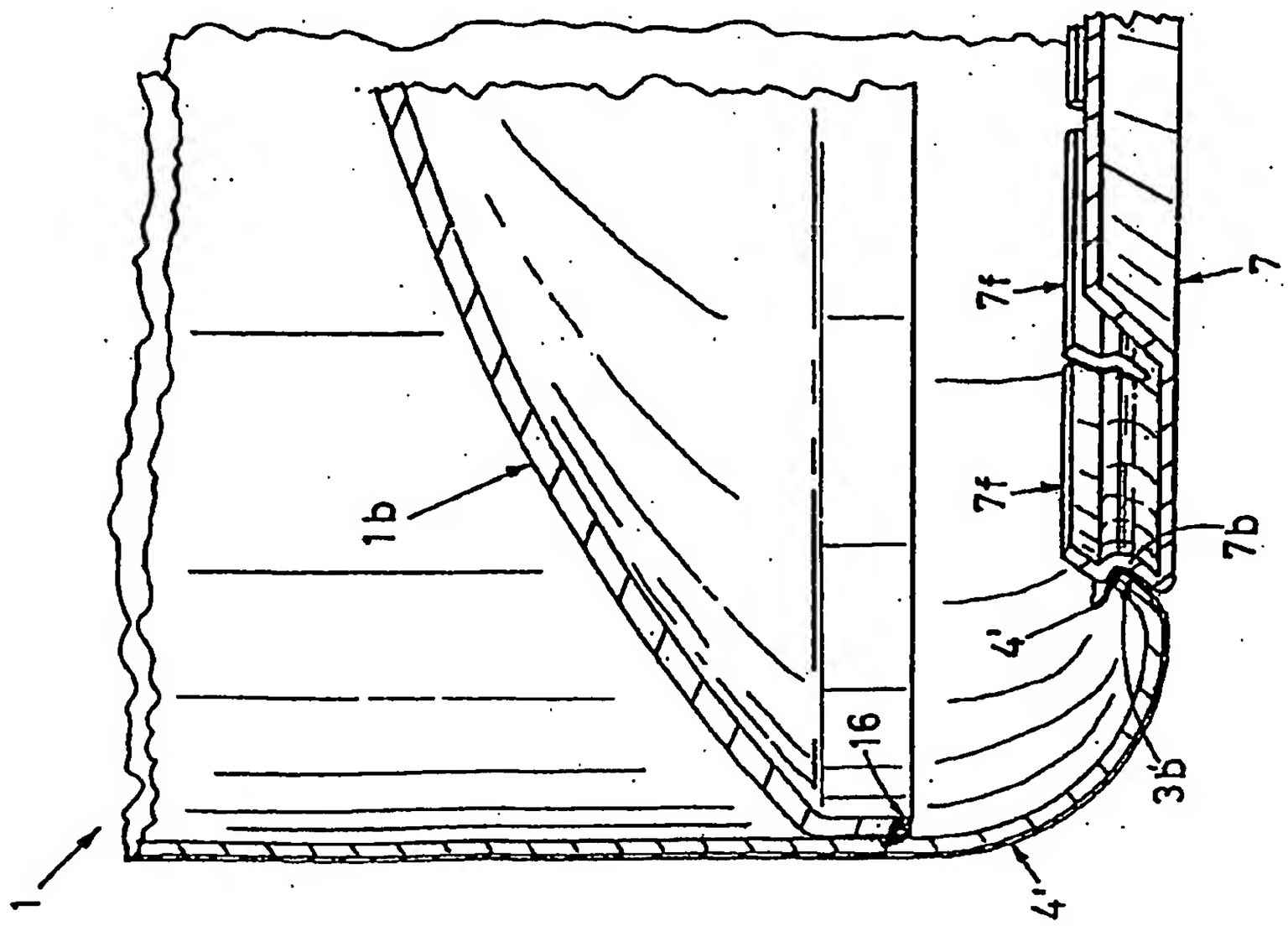


Fig.7

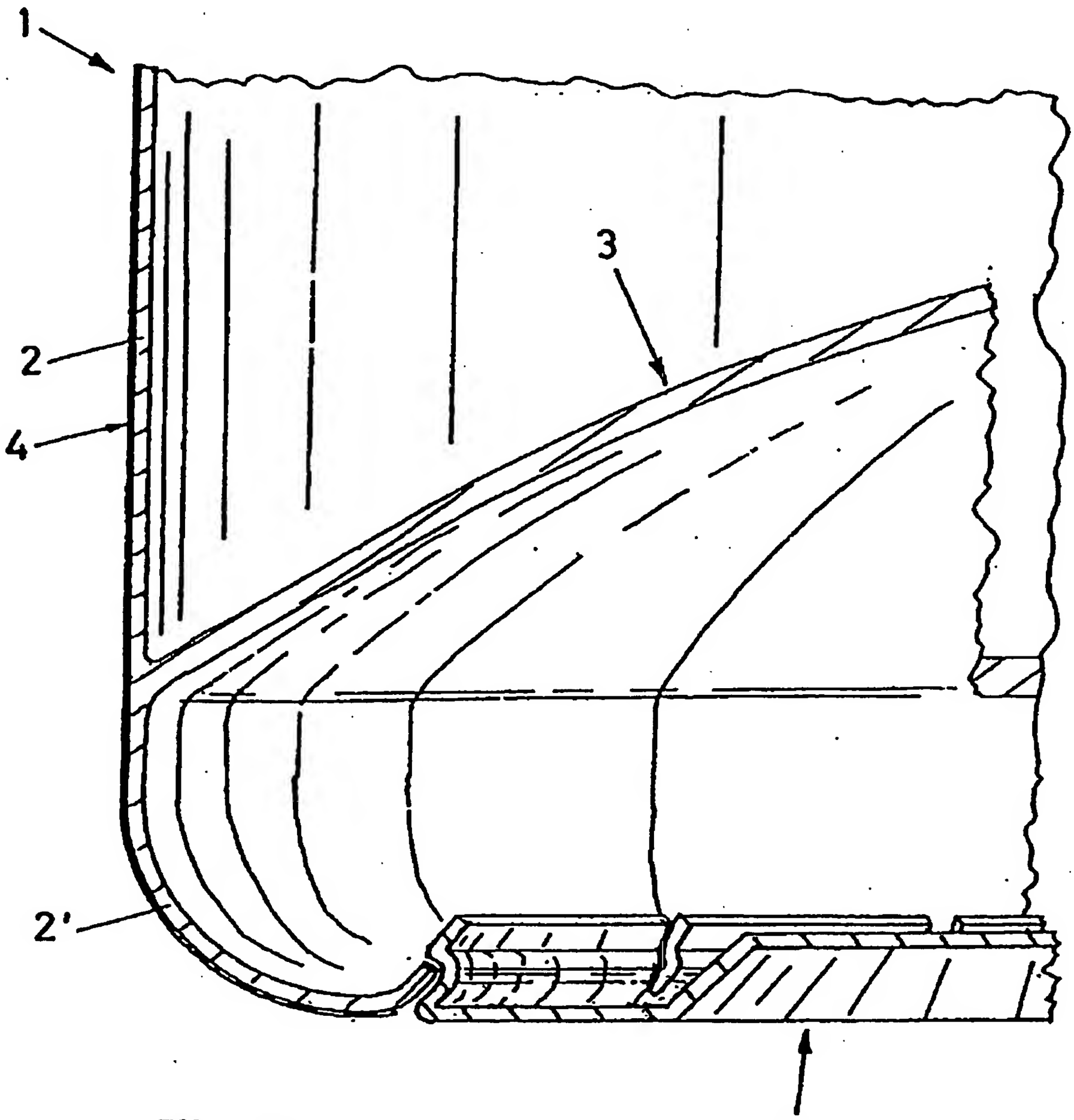


Fig.9

DOSING BODY WITH AN EXTERNAL BASE COVERING, METHOD AND DEVICE FOR APPLYING THE BASE COVERING

[0001] This application is the national phase under 35 U.S.C. § 371 of PCT International Application No. PCT/CH02/000609 which has an International filing date of Nov. 13, 2002, which designated the United States of America and which claims priority on Swiss Patent Application number 158/02 filed Jan. 30, 2002, the entire contents of which are hereby incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The invention generally relates to a can body, to a method and to a device. The invention concerns vessels or cans which include a base on one end face of a jacket-like closed wall, and of which preferably at least one layer of the wall and the base is made of metal.

BACKGROUND OF THE INVENTION

[0003] Vessels may be formed, for example, as aerosol cans or as beverage cans. Further, cans may be made of aluminum as well as of sheet steel. In order to give the vessels a desired appearance and to apply the necessary information, the jacket-like wall is provided with decoration and labeling. The decoration is, for example, directly printed onto the can. If need be, however, the decoration can be printed onto labels or foils that are then applied to the can wall.

[0004] One printing cylinder must be used per color with the current printing method. The printing costs correspondingly increase with each color required. In addition to decorative or graphically configured labelings, standardized information, such as perhaps a bar code, information on hazards and the composition of the product, and if need be promotional information, must also be applied to the can wall. Moreover, a bar code with a dark color, preferably black, must be printed on bright background, preferably white, which strongly impairs the aesthetic effect of the decoration, especially with dark overall surfaces.

[0005] Furthermore, usually two additional colors with the corresponding printing costs are needed for the bar code. Only the precise number of cans that are to be brought into commerce with the current bar code or the current advertising information may be manufactured. In the event that the same can is to reach the market at another point in time with another bar code, then additional cans with the old decoration and the new bar code or new advertising information must be manufactured. If need be, a label with the new bar code can be manufactured, which is glued over the old bar code or the old advertising information, which is associated with much expenditure and is not aesthetically satisfactory.

[0006] It is likewise aesthetically unsatisfactory that in cans having a curved transition region from the can base to the can wall the decoration cannot be printed on in the transition region after the base is formed, which, when the can is standing on its base is manifest as an unsightly or not printed lower edge.

[0007] Due to lower manufacturing costs, today more and more products are being sold in cans made of sheet steel. It has now been found that such sheet steel cans rust on the base, especially when used in wet cells. The cans may stand over long periods of time with their annular support surfaces on a wet surface, or if worst comes to worst, on surfaces that are contaminated with other substances. Moreover, moisture and materials added to this as well as electrical effects can bring about corrosion.

[0008] Even with sheet metals that are provided with a thin chromium layer, undesired oxidation has already been observed. The corrosion leads to a contamination of the surface on which the can is standing, and weakens the base of the can. A weakened can base is dangerous in aerosol cans, especially when butane or propane is used as the propellant gas.

[0009] In order to be able to withstand the pressure in the interior of the can, aerosol cans have a base that is arched toward the can's interior. This base is constructed via a pressing process and includes an inwardly arched central region and a downwardly projecting annular edge region where the can base transitions into the can jacket. The cans stand on the annular edge region that can be weakened by corrosion along the support line so that the central region of the base could break out. With can materials having a thin chromium layer, the chromium layer along the support line can be damaged or eliminated by rubbing motions on conveyor facilities of the filler so that corrosion protection is absent to some extent in the corrosion-endangered edge region. Cans whose bases are connected to the jacket via a fold have a narrow, annular downward standing rim that can be easily damaged or oxidized. Corrosion and possibly other chemical and electrical effects can lead to undesired discolorations of the surface on which the can stands.

[0010] Solutions are known from the publications EP 200 098 A2 and EP 208 564 in which elements of two-part and multiple part cans are joined with laser beams. Here the elements to be joined are arranged butted, overlapping and also running toward one another at right angles. The laser welding seam is formed for example on the end face, penetrating one layer or as a flat-lap weld. The solutions described are not aesthetically attractive and cannot prevent a possible corrosion of the base.

[0011] From U.S. Pat. No. 4,455,850 a beverage can is known in which the central inwardly arched region of the base is coated with a dull color. In this manner, sunlight is prevented from being focused by the concave can base, which could cause a fire to be ignited by cans thrown away outdoors. The coating does not extend over the annular transition region so that the corrosion problem is not solved.

[0012] Moreover, the paint is sprayed onto the flat sheet metal so that when stamping out the sheet metal disks and deep drawing the cans, care must be taken that the applied round paint spots are struck exactly centrally by the stamping tools, which is associated with an increased manufacturing expenditure. Even if the paint were to extend over the annular transition region, the paint layer would no longer be continuous after deep drawing the can and pressing the base. Also, rubbing the transition region on conveyors of filling assemblies would lead to damage of the paint layer. Without a continuous paint layer, the already mentioned danger of corrosion exists once again.

[0013] A beverage can is known from U.S. Pat. No. 5,992,892 in which information is printed on the central

inwardly arched region of the base that is covered with a coating that can be rubbed off in the finished can. This solution makes possible an advertising game in which the buyer of a can can determine, after rubbing off the layer, whether he/she has won anything in accordance with the information lying under it. The annular transition region with the supporting ring thus remains without coating, hence the corrosion problem is not solved. Moreover, the rubbed off coating, or the coating that can be worn off, is not suited for continuously coating the support ring. The removability of the coating is crucial for the promotional game.

[0014] U.S. Pat. No. 6,073,797 discloses a cover that is engageable in connection with the upper end face with the aperture to a beverage can. In order that the top remains locking on the can, an outwardly projecting annular region must be provided on the can end, via which a corresponding elastic annular region of the cover can be inverted until it locks. Such a top is very expensive to manufacture and install. Moreover it cannot be installed on the can base due to the lack of an outwardly projecting annular region.

[0015] A further cover that is installed by screwing only at the opening of a beverage can is known from U.S. Pat. No. 5,711,447. The screw lock of this cover requires outwardly projecting ribs on the beverage can that can interact with inward-standing elements on the cover. The features necessary on the can and on the cover for use of the cover are extremely expensive to manufacture It is also very expensive to screw the cover onto the can. Therefore, the possibility of arranging a promotional article in such a screw lock is associated with an excessive expenditure.

SUMMARY OF THE INVENTION

[0016] An embodiment of the present invention is based upon the task of finding a simple solution for a can that can advantageously be aesthetically configured without being impaired by a bar code or advertising information. In particular, a possible corrosion on the base is to be prevented.

[0017] In one embodiment, it was recognized in accomplishing the objective that corrosion problems and aesthetic problems can both be solved by applying an external covering in the form of a sheet material. The sheet material is fixed in position on an annular connection region of the can body. If the connection is formed along a closed circular line, the membrane-like base covering receives a high level of stability.

[0018] The base covering is basically constructed flat in a main region that is surrounded by the annular connection region and preferably includes the printout of a bar code. If the bar code can be applied on a basically even base surface, then the impairment of the possibility of designing the can wall disappears. No printing rollers for the bar code are necessary for printing the decoration on the can wall. Large amounts of can bodies with an attractive standard decoration on the can wall can be manufactured. Possibly changing information, or information that is not identical for all countries, such as the bar code or even the filling date, and/or aesthetically disturbing information are printed on the base covering. These potentially different base coverings can be printed shortly before the filling time of individual product batches, and can be fixed into position on the standard of the can body. In this way, the same can can be used for all countries and filling batches.

[0019] Because the base covering can be constructed flat in the region of the bar code, the bar code is more readable than a bar code that is applied to a curved can wall. If the coating of the exterior of the can wall extends up to the outer edging of the base covering in the form of at least a paint layer or a decorative foil, then a metallic edge becoming visible on the lower can edge can be prevented. The base covering may cover an annular downward-projecting stand region of the can body, thus preventing the occurrence of corrosion problems.

[0020] The base covering is preferably constructed in the form of a sheet plastic material. It is obvious that sheet material having at least one metal layer, especially an aluminum or steel layer, or even with a cardboard layer, can also be used. Here the stability-imparting layer may also be coated with plastic.

[0021] The sheet materials that are used should guarantee a robust base covering that will not be damaged on the conveyor apparatuses of filling assemblies and also will remain as constant as possible even when standing on wet supports. The aforementioned sheet materials can all be provided with a sealing coating and consequently can be sealed on the base. When metal foils are used, the heat required for the sealing process can also be introduced inductively. A latching connection or a welded connection can also be used instead of a seal connection for fixing the base covering into position, especially with at least three laser welding points.

[0022] It is obvious that the base covering of an embodiment of the invention is not restricted to use in cans. There are also vessels, especially plastic bottles, the bases of which include an annular downward projecting base region and on which consequently a base covering can be fixed. Although there exists no danger of corrosion with plastic vessels, the use of base coverings for the placement of bar codes and advertising information on vessel bases is advantageous.

[0023] If a decorative layer in the form of at least one paint layer, but preferably as a decorative foil, is applied on the exterior of the can wall, then the base covering can be constructed such that the decorative layer extends at least to the outer edging of the base covering. Preferably, however, the decorative layer is somewhat overlapped by the base covering. This prevents foils from being able to loosen on the end region of the can body when decorative foils are used.

[0024] When decorative foils are used, a can body with a can wall and base can be manufactured economically corresponding to the respective requirements. If need be, a decorative foil can be subsequently applied to the can wall so that imprinting the can body can be dispensed with. If the can wall and base are pressed from a single element, as perhaps with aerosol cans made of aluminum or with cans made from steel sheets, then the necessary intensive cleaning and drying for imprinting can be dispensed with. A peeling of the foil can be ruled out with foils closed in the peripheral direction that are overlapped by the base covering. If the can body is assembled from a jacket and a base, these two parts may be joined to one another via a folded seam, but preferably a welded seam, especially a laser welded seam. A decorative foil is preferably applied after this joining step, wherein preferably a close and in particular firm application of the foil on the can body can be guaran-

teed by using a shrinkable foil, especially with a sealing layer that faces the can body. If the can jacket and base are joined using a folded connection, then the folded connection may also be made after the decorative foil is applied, whereby then the folded seam would take over holding the foil on the lower end of the can.

[0025] The base covering, or if need the decorative foil as well, permits a covering of the connection between the jacket and base so that no high aesthetic standards must be imposed on this connection. When a welded seam or laser connection is used, the annular connection region is preferably formed by an end region of the can jacket projecting over the base, wherein this end region is drawn especially somewhat toward the can axis and forms the annular transition region. With a folded seam, this can be constructed in the region of the can base and if need be can be pressed toward the interior of the can such that a curved jacket end region can be used as an annular connection region. With these described variants, a base covering that is fixed into position on the annular connection region bridges the respective connection seam

[0026] In order to produce an aesthetically attractive can body, the transition from the can wall to the base covering is constructed circular segment-like in longitudinal section, whereby it preferably has a curvature radius ranging from 1 to 6 mm, especially basically 3 mm.

[0027] Thanks to the base covering it is now possible, for example, to furnish a two- or three-piece aerosol can of sheet steel that has the appearance of a one-piece aluminum can. The possible embodiments in the base area have already been described above. In order to form the valve seat on the upper end face of the can, a compression necking process can be provided in the case of a two-piece can, and the use of an upper end piece with valve seat in the case of a three-piece can.

[0028] Obviously the invention includes all solutions resulting from the combination of the features and embodiments described. Varying the features includes, for example, choosing between one-, two- or three-piece cans, with two- and multiple-piece cans, the choice of various modes of connection between the parts, providing or omitting a decorative foil, the choice of a specific base covering and its fastening on the can body as well as the selection of material for the can and the base covering. Even unexpected combinations can lead to advantageous solutions. Thus, for example, a one-piece aluminum can with a base covering that includes magnetizable sheet steel has the advantage that this can can be conveyed via magnetic conveyors while using magnetic forces of adhesion with various axis alignments.

[0029] The possibility of clamping a decorative foil firmly on the lower can end with the base covering opens up a many sided use of decorative foils. These foils are imprinted when needed on their exterior, but preferably on the side facing the can body. The printed layer is protected with a transparent foil that is imprinted on the reverse side, or on the side facing the can body, so that no friction-conditioned impairments of the decoration can arise. A transparent foil printed on the reverse side can be provided with a sealing layer after imprinting through the printed layer, which also guarantees a seal connection between the foil and the can body. In order to be able to shrink the foil on the can body, a piece of foil is shaped in a first step into a closed foil jacket and joined together on the two side lines allocated to each other, whereby preferably a seal connection is created. This foil jacket has a slightly greater cross section than the can body and can thus be inverted over the can body and shrunk on the latter as well as sealed fast with the application of heat. After applying the decorative foil, the base covering is fixed into position such that it somewhat overlaps the foil end on the base. It is obvious that the base covering can also be constructed annularly so that it holds the end of the foil securely on the can body but does not completely cover the can base.

[0030] Applying foils to a can body is known, for example, from EP 1 153 837 A1, wherein however there with each foil segment, the printed layer may not be applied up to the foil edge, respectively a blank foil edge is needed. In accordance with this known solution, a sealing layer arranged between the foil and the printed layer must lie open when constructing the closed foil jacket to generate a sealing seam. Therefore the imprinting and the succeeding cutting of the foil track must be exactly harmonized with each other, which is not attainable with simple expenditure with a thin foil due to its elastic deformability. In this connection the present invention provides a simplification. Because a sealing layer is applied to the printed layer, the printed layer can be constructed continuously. Cutting the pieces of foil need not precisely agree with the printing, and the formation of a sealing seam is always guaranteed.

[0031] A sufficiently shrinkable foil can guarantee that the decorative foil lies free from folds on the body after the shrinking process in the drawn-in base region, and if need be also in a drawn-in upper end region. Because weld seams and especially laser connections can be constructed such that the surface of the can body is basically smooth even in the region of the seam, it can no longer be recognized after applying the decorative foil and the base covering that the can body was brought into the desired shape using seams. With cylindrical can bodies, a rectangular sheet is shaped into a can jacket with a longitudinal seam. But it would also be possible to assemble the can jacket out of two or more jacket pieces with two or more longitudinal seams so that if need be a jacket deviating from the cylindrical shape arises. The deviation from a circular cylindrical shape can arise in the cross section as well as in the longitudinal direction.

[0032] In order to be able to hold a decorative foil extremely securely on the can body even on the upper end of the can, an annular covering element is also provided there. This upper covering element is formed in connection with aerosol cans if need be from a sub-region of the valve or from a part fastened onto the valve seat. It is obvious that it can also be fixed in position on the upper end of the can analogously to the base covering through a seal connection, a latching connection or a welding connection, especially with at least three laser welding points, wherein this part covers the upper foil end and therewith protects it from tearing off.

[0033] Covering the foil end on at least one end of the can, especially below, makes it possible to dispense with cutting the foil or foil jacket exactly to size in the direction of the axis of the can without in this way an unsightly end being able to make an appearance. Moreover, folds that could form on strongly necked end regions are covered by the base covering and/or by the annular covering element.

[0034] Embodiments should also be included in which the base covering lies directly on the base with a surface adapted to the shape of the base and is in particular sprayed directly on the base as an injection molded component.

[0035] The solution of the embodiments of the invention opens up new configuration possibilities for cans. Moreover, simplifications in can manufacturing result, allowing the cans to be assembled directly at the filling site. This has the advantage that the space-consuming transport of empty cans from a facility for manufacturing cans to the various filling facilities can be dispensed with. The cans are, for example, assembled from a flat sheet metal piece from which the jacket is formed, from a base component, an upper end component, and a base covering, along with a decorative foil. The base elements, the upper end elements and the base coverings can be stacked with little free space and can consequently be transported in a space-saving manner like stacks of pieces of sheet metal and foil rolls.

BRIEF DESCRIPTION OF THE DRAWINGS

[0036] Further advantages, features and details of the invention will become evident from the description of illustrated exemplary embodiments given hereinbelow and the accompanying drawings, which are given by way of illustration only and thus are not limitative of the present invention, wherein:

[0037] **FIG. 1** illustrates a vertical section through an aerosol can in accordance with the state of the art,

[0038] **FIG. 2** Illustrates a cutaway of a vertical section through an aerosol can with a base covering,

[0039] **FIG. 3** Illustrates a cutaway of a vertical section through an aerosol can with a base covering and an advertising article **FIG. 4** illustrates a vertical section through an aerosol can and a device for applying a base covering,

[0040] **FIG. 5** Illustrates a vertical section through an aerosol can with a base covering, wherein the can body is assembled from three parts,

[0041] **FIG. 6** Illustrates a detailed cutaway from the base region of a can in accordance with **FIG. 5** with a base covering that is fixed into position using a sealing or welding connection,

[0042] **FIG. 7** Illustrates a detailed cutaway of a can with a base covering that is fixed into position using a latching connection,

[0043] **FIG. 8** Illustrates a detailed cutaway of a can with a base covering, wherein can base and jacket are connected through a folded connection, and

[0044] **FIG. 9** Illustrates a detailed cutaway of a one piece can with a base covering that is fixed in position using a latching connection.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0045] **FIG. 1** illustrates a can body **1** in accordance with the state of the art with a jacket-like closed can wall **2** and a base **3** on the lower end face of the can wall **2**. This is an aerosol can whose base **3** is arched with a central region **3***a* against the can interior. A downwardly projecting annular edge region **3***b* is formed around the central region **3***a*. The cans stand on a support line of the annular edge region **3***b* wherein the support line can be weakened by corrosion so that the central region **3***a* can break out. The can wall and the base include a metal layer **5**. A decorative layer **4** is arranged on the exterior of the can wall **2** or at the metal layer **5** that extends from a valve seat **6** through a conified neck and the predominant region of the can wall **2** up to the transition wall from the can wall **2** to the base **3**. An uncoated can region is visible beneath the lower edging of the decorative layer **4**.

[0046] **FIG. 2** shows a preferred embodiment of an aerosol can **1** with an external base covering **7** in the form of a plastic sheet material that is fixed to a downward projecting annular edge region **3***b* of the base **3** with a seal connection **8**. The edge region **3***b* consequently forms a connection region on which the base covering **7** is fixed into position. The base covering **7** includes a contact region **7***b* that lies on the edge region **3***b*. The seal connection **8** extends at least over a sub-region of the contact region **7***b* and is preferably formed by a sealing layer arranged on the base covering **7** that was sealed by a sealing apparatus to the edge region **3***b*. It is obvious that the connection between the edge region **3***b* and the contact region **7***b* can also be attained with an adhesive.

[0047] The decorative layer **4** can be constructed as a coating on the exterior of the can wall **2** in the form of at least one layer of paint as well as in the form of a decorative foil. The decorative layer **4** extends preferably at least up to the outer edging of the base covering **7**. In the embodiment represented, the decorative layer **4** is somewhat overlapped by the base covering **7**. In this way, the metal layer **5** can be prevented from being accessible in the base region. A danger of corrosion is consequently ruled out. The flat sheet material of the base covering **7** has a layer thickness of at least 0.02 mm, preferably, however, in the range from 0.08 to 0.8 mm, especially from 0.2 to 0.6 mm. In this way, the strength necessary for different mechanical stresses can be guaranteed.

[0048] The base covering **7** includes a main region **7***a*, surrounded by the contact region **7***b* or by the inner edging of the seal connection, that is basically constructed flat and in particular includes the printout of a bar code. The base covering **7** includes a tear-apart device if need be that is constructed somewhat in the form of a weakened tear apart line in the main region **7***a*. By tearing along the tear-apart line using a strap, a part of the main region **7***a* of the can can be removed or at least swung out. Winning information can be applied on the interior surface of this element that becomes accessible via the tearing. A base covering **7** that can be torn off enables effects that permit advertising.

[0049] **FIG. 3** illustrates a base covering **7** with a first and a second covering element surface **7***c* and **7***d*, wherein the first covering element surface **7***c* is connected via the seal connection **8** with the edge region **3***b* of the base **3**, and the second covering element surface **7***d* is fixed into position separably on the first covering element surface **7***c*. In order to be able to separate the covering surface **7***d*, a grasping strip **7***e*, for example, is constructed on the covering element surface **7***d*. If the first covering element surface **7***c* has an opening in the central region, an advertising article **9** arranged between the central region **3***a* of the base **3** and the base covering **7** can be removed after separating the second covering element surface **7***d*. The base covering **7** makes

possible numerous advertising effects. The covering subsurface *7d* can, for example, be constructed as a collection piece that has on the one side a motif or an image and if need be a designation for it on the other side. The advertising article **9** and/or the covering subsurface *7d* can include collection points, good luck sayings or even recipes. If beverages are poured into the can body, a beverage additive, such as perhaps vitamins, alcohol, stimulants or sweeteners, may be arranged in the hollow space between can base and the base covering instead of the advertising article. It would also be advantageous to sell medications directly with water, wherein the medication would be arranged between the can base and the base covering of the vessel with the water.

[0050] **FIG. 4** shows a device with which the base covering **7** can be sealed fast to the downward projecting annular edge region *3b* of the base **3**. The device includes a retaining apparatus for retaining the can body and a sealing apparatus **10** with an annular sealing surface *10a* that is adapted to the edge region *3b* of the base **3**. In order to heat the sealing surface *10a* to a desired temperature, the sealing surface *10a* is allocated a heating device *10b*. The heating apparatus must be constructed such that the sealing surface *10a* is movable relative to the base **3**. In the embodiment represented, the retaining apparatus includes a centering apparatus **11** that extends ring-like around the sealing apparatus **10** for accommodation of the can base **3** and a hold down apparatus **12** that in interaction with the sealing apparatus **10** makes attainable the desired contact pressure between the base covering **7** and the base **3** of the can body **1**. In order that the base covering **7** does not need to be moved by the heated sealing apparatus **10** to the base **3**, the sealing apparatus **10** preferably includes a feeding apparatus **13** that is movable relative to the sealing surface *10a*.

[0051] In accommodating a base covering **7** that can if necessary be fed in from the side, the feeding apparatus **13** is arranged over the sealing surface *10a*. After a can body **1** is inserted into the centering apparatus **11**, the base covering **7** is moved by the feeding apparatus **13** toward the base **3**. Subsequently the annular sealing surface *10a* presses the contact region *7b* against the edge region *3b* until the heat administered has attained the desired sealing connection **8**. It is obvious that the retaining apparatus and the sealing apparatus can be configured in accordance with solutions from the state of the art. In particular, it would also be possible to provide a retaining device that retains the can body solely from an end face and/or holds the latter with the base upward.

[0052] In order to implement the sealing connection between the can base and the base covering, at least one processing station is provided, which preferably includes a rotary table, to which is allocated sealing apparatuses rotating along with it. In this manner, the sealing can be conducted during the rotary motion of the rotary table. Such a processing station can, for example, be arranged in the filling operation before or after filling.

[0053] **FIG. 5** shows the can body **1** of an aerosol can **1**, wherein the can body **1** is assembled from a jacket element *1a* and a base element *1b*. The view of the connection between the base element *1b* and the jacket element *1a* is covered by the base covering **7**. The jacket element *1a* is provided with a decorative layer **4** that if necessary can be printed directly onto the cylindrical can body. If the jacket element *1a* is made out of a sheet of metal by transformation and application of a welded seam, then the decorative layer **4** can also be previously printed upon the flat metal sheet. A valve seat is constructed at the upper end of the can body **1** by die necking and transforming the opening into a valve seat. If need be, a decorative foil is shrunk on directly after the necking, basically extending to the end corner of the jacket element *1a* so that the end of the foil is clamped after transforming by the transformed can edge.

[0054] If the decorative layer **4**, especially the decorative foil, does not extend to the upper edge of the can, an upper covering element **14** can be arranged on the upper end of the can, at least covering the can end region without decorative layer. If the can body is made of three parts, an upper end piece with the valve seat must be fixed into position on the jacket element *1a*. In accordance with the state of the art, this is done with a folded seam or if need be via welding (EP 208 564 B1). The unattractive seam region thereby arising between the upper end element and the jacket element *1a* can be covered by the upper covering element **14**. In the case of an aerosol can, the upper covering element **14** is an element that is connected to the valve and always rests on the can following insertion of the valve. By providing covering elements **7**, **14**, three-piece cans can be furnished in which the consumer cannot recognize that the can body **1** is composed of various parts. Basically all known types of connection for tightly connecting can elements can be used.

[0055] In the embodiment in accordance with **FIG. 5**, the base element *1b* is connected via an annular welding connection to the jacket element *1a*. On the base, an edge region of the base element *1b* extends along the jacket element *1a* adjacent to the lower edge of the jacket element *1a*. The welding connection can be made in the form of a fillet seam or also in the contact region of these two elements by penetrating one element. It is obvious that the elements can also be butt welded, that at least one of the two connections could be constructed as a folded connection, or that a connection is provided only below or only above. Without using an upper end piece, the jacket element *1a* must be strongly necked to form a valve seat, which is for various materials associated with great expenditure, especially with many die necking steps, and in the worst case with insurmountable problems. Due to the covering possibility, an optimized assembly of the can body can be selected without it appearing negative in appearance.

[0056] If the can body is provided with a decorative foil, the base covering **7** and if necessary also the upper covering element **14**, can be used to protect or firmly clamp the lower or upper foil edge. In this way, the danger of a decorative foil loosening can be substantially reduced. Even welded seams in the longitudinal direction of the can can be covered with a decorative foil. A can jacket that is formed by bending and welding, especially laser welding, can already receive a special shape by cutting the assembled elements to size. Because the material of the at least one metallic sheet material shaped into the jacket is not hardened by transformation steps, the jacket can at least be transformed regionally by altering the periphery. In this way, aesthetically attractive cans can be formed that can be provided with a shrinking decorative foil before or if necessary after transformation. Consequently, new configuration possibilities result.

[0057] **FIG. 6** shows a cutaway from a can body **1** in which a base element **1***b* is permanently welded to the jacket element **1***a*, projecting upward, dome-like. A welded connection **16** is formed between an annular region **15** and a peripheral line of the jacket element **1***a* that, for example, extends through the annular region **15** to the jacket element **1***a* and is preferably generated via laser welding. With aerosol cans, the can interior must accommodate an increased pressure. A fold-like strengthening of the annular region **15** prevents a detachment of the base element **1***b* from the jacket element **1***a*. With an impermissibly high internal pressure, the arching of the base element **1***b* can deform toward the outside and thus indicate the excess pressure as well as prevent a bursting. The base covering **7** includes a main region **7***a* surrounded by the contact region **7***b* that is preferably constructed basically flat and can in particular accommodate the printout of a bar code. In the embodiment represented, the contact region **7***b* is fixed in position on a corresponding annular connection region **3***b*' on the lower end of the jacket element **1***a*. An adhesive or seal connection **8**, for example, can be provided for fixing into position. If the material of the contact region **7***b* includes metal, the connection can also be guaranteed by weld points **17**, for example at least three laser welding points.

[0058] In the represented embodiment, a decorative layer **4** in the form of a decorative foil **4**' is situated on the exterior of the can body **1**. The decorative foil **4**' is shrunk fast before the base covering **7** is fixed into position on the can body **1**. The lower edge of the decorative foil **4**' need not be exactly cut to size because it is covered by the base covering **7**. It extends at least somewhat into the connection region **3***b*', but can also project somewhat over the edge of the jacket element **1***a*. The seal connection must consequently be at least partially constructed between the exterior of the decorative foil **4**' and the contact region **7***b* with a sealed connection between the contact region **7***b* and the connection region **3***b*'. The decorative foil **4**' should thus adhere sufficiently well to the connection region **3***b*' For this, sealing layers are present approximately in the connection region on both sides of the decorative foil, which guarantee a fast connection due to the sealing process. The transition from the jacket element **1***a* or from the can wall **2** to the base covering **7** is constructed in the form of a circular segment in longitudinal segment or is drawn in toward the interior and preferably has a curvature radius ranging from 1 to 6 mm, especially basically 3 mm. This radius permits in comparison to corners an unimpeded conveyance even over short steps. If need be, the base covering **7** forms a base wherein a standing can body **1** is only in contact with the support surface through the base covering **7**.

[0059] **FIG. 7** shows an embodiment in which the base element **1***b* is fastened to the jacket element **1***a* via a welded seam **16** in the form of a fillet seam. The base covering **7** is fixed into position with a latching connection on the lower edge region of the jacket element **1***a*. The connection region **3***b*' is formed by the lower and free edge region of the jacket element **1***a*. The contact region **7***b* of the base covering **7** lies form-locking on the connection region **3***b*' and is preferably formed by spring lips **7***f*, so that the base covering **7** can be inserted under spring deformation of the spring lips **7***f* on the underside of the can body **1**. The decorative foil **4**' extends between the jacket element **1***a* and the base element **1***b* over the connection region **3***b*' and is consequently clamped fast on the can body **1** by the base covering **7**.

[0060] Because it is possible to omit a seal or welded connection, the base covering **7** does not need to be sealable or weldable. Consequently, any desired plastics or even metals, especially coated and/or magnetic metals, can be used to manufacture the base covering. The spring lips **7***f* can be constructed in any desired form and are provided at least at three points basically equally spaced in the peripheral direction. Because positioning a latching element without a sealing or welding device can be conducted by a single linear motion of a pressing element, the method as well as the device for fixing a latching base covering in position are extremely simple.

[0061] **FIG. 8** shows an embodiment in which the base element **1***b* is joined to the jacket element **1***a* via a folded connection **18**. The folded connection **18** is preferably so constructed and deformed toward the interior of the can that the transition from jacket element **1***a* or from the can wall **2** to the base element **1***a* is in the form of a circular segment in the longitudinal section and includes a connection region **3***b*' for fixing the base covering **7** in place. A sealing or welding connection is constructed between the connection region **3***b*' and the contact region **7***b* for fixing the base covering. The folded connection **18** is covered over by the base covering **7**. If necessary a decorative foil **4**' extends along the jacket element **1***a* up to under the contact region **7***b*.

[0062] **FIG. 9** shows an embodiment in which a can body **1** was constructed using pressing, especially cold impact pressing, such that the base **3** transitions into the upright standing can wall **2** and into a wall segment **2**' standing downward. The can wall **2** together with the wall segment **2**' will form a cylindrical jacket surface directly after pressing that can, which surface for example, can be imprinted with a decorative layer **4**. The wall segment **2**' is somewhat drawn in, in order to be able to fix the base covering thereon. In the embodiment represented, the decorative layer extends basically up to the base covering. That means that the entire region of the can body **1** visible from the side has a decoration. If necessary a foil that extends up to beneath the base covering is provided. If the can body is made of aluminum, then a can body that can be conveyed using magnetic conveyors can be furnished by inserting a base covering **7** with magnetizable metal.

[0063] Exemplary embodiments being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the present invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.

1. Can body, comprising: a jacket-like closed can wall extending around an axis of the can; and a base constructed on one end of the can wall, wherein at least in one sub-region of the base, an external base covering is constructed in the form of a sheet material and is fixed—into position on an annular connection region of the can body, a decorative layer is constructed on the exterior of the can wall in the form of at least one paint layer and wherein the decorative layer extends at least to the outer edging of the base covering.

2. Can body according to claim **1**, wherein the decorative layer is somewhat overlapped by the base covering.

3. Can body according to claim **1**, wherein at least one layer of the can wall and the base is made of metal.

4. Can body according to claim 1, wherein the can walls and the base are at least one of made from a single piece and joined to one another via a seam.

5. Can body according to claim 1, wherein at least one of a sealed connection, a latching connection, and a welded connection is constructed between the base covering and the can body.

6. Can body according to claim 1, wherein the base covering is fixed into position on the base, on one end region of the can wall projecting over the base that is somewhat drawn in toward the axis of the can, wherein the transition from the can wall to the annular connection region is constructed in the form of a circular segment.

7. Can body according to claim 1, wherein the base covering forms a standing region, and wherein a standing can body is only in contact with a support surface through the base covering.

8. Can body—according to claim 1, wherein the base covering is constructed basically flat in a main region that is surrounded by the annular connection region.

9. Can body according to claim 1, wherein the base covering includes tear apart device in the form of a first and a second covering subsurface, wherein the first covering subsurface is joined with the base via the seal connection and the second covering subsurface is fixed separably into position on the first covering subsurface.

10. Can body according to claim 1, wherein a hollow space, especially for accommodating an advertising article, is constructed between the base covering and the base.

11. Method for applying a base covering in connection with the base of a can body with a can wall that extends like a jacket around the axis of the can, and a base constructed on one end of the can wall, wherein at least one layer of the can wall and the base is made of metal and a decorative layer is constructed on the exterior of the can wall in the form of at least one paint layer, comprising:

fixing the base covering in the form of a sheet material into position on an annular connection region of the can body and wherein after said fixing. the decorative layer extends at least to the outer edging of the base covering.

12. Method according to claim 11, wherein, before the base covering is fixed into place, the can wall and the base are joined to one another via a seam, and the end region of the can wall that projects over the base is, if necessary, somewhat drawn in against the can axis.

13. Method according to claim 11, wherein, before the base covering is fixed into position, a decorative foil is arranged on the exterior of the can wall and an end region of the decorative foil is covered over by the base covering when the base covering is being fixed into position.

14. Device for applying an external base covering on a base of a can body that includes a closed can wall that extends like a jacket around an axis of the can, a base that is constructed on the one end of the can wall and a decorative layer constructed on the exterior of the can wall in the form of at least one paint layer, the device comprising:

a retaining apparatus for retaining the can wall, wherein the retaining device holds the base of a retained can body free, and a position fixing apparatus makes the base covering movable toward the base and able to be fixed into position there, wherein after said fixing, the decorative layer extends at least to the outer edging of the base covering.

15. Device according to claim 14, wherein the position fixing apparatus comprises a feeding apparatus for feeding a base covering to the base of a can body held by the retaining apparatus, and includes at least one of a sealing apparatus, a pressing apparatus and, a welding device.

Device according to claim 14, wherein the retaining apparatus includes a centering apparatus for accommodating the base and a hold down apparatuses, wherein the hold down apparatus, in interaction with the position fixing apparatus, makes a

16. desired contact force attainable between the base covering and the annular connection region of the can body.

17. Can body according to claim 1, wherein a decorative layer includes a decorative foil.

18. Can body according to claim 1, wherein the base covering is at least partially made of metal.

19. Can body according to claim 1, wherein the base covering is at least partially made of plastic.

20. Can body according to claim 1, wherein the base covering has a layer thickness of at least 0.02 mm.

21. Can body according to claim 1, wherein the base covering has a layer thickness in the region from 0.08 to 0.8 mm

22. Can body according to claim 1, wherein the base covering has a layer thickness in the region from 0.2 to 0.6 mm.

23. Can body according to claim 1, wherein the can wall and the base are joined to one another via a welded seam.

24. Can body according to claim 1, wherein the can wall and the base are joined to one another via a laser welded seam.

25. Can body according to claim 6, wherein the transition from the can wall to the annular connection region is constructed with a curvature radius in the range from 1 to 6 mm

26. Can body according to claim 25, wherein the curvature radius is basically 3 mm.

27. Can body according to claim 8, wherein the base covering includes an imprintable region.

28. Can body according to claim 1, wherein a hollow space, for accommodating an advertising article, is constructed between the base covering and the base.

29. Can body according to claim 1, wherein the base covering, with a surface adapted to the shape of the base, lies directly on the base.

30. Can body according to claim 29, wherein the base covering is sprayed directly onto the base as an injection molded component.

31. Method according to claim 12, wherein the can wall and the base are joined to one another via a welded seam.

32. Method according to claim 12, wherein the can wall and the base are joined to one another via a laser welded seam.

33. Device according to claim 15, wherein the retaining apparatus includes a centering apparatus for accommodating the base and a hold down apparatus, wherein the hold down apparatus, in interaction with the position fixing apparatus, makes a desired contact force attainable between the base covering and the annular connection region of the can body.

34. Can body according to claim 8, wherein the base covering includes an imprintable region including a bar code.

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(54) **METHOD AND DEVICE FOR THE PRODUCTION OF A CAN BODY, AND CAN BODY**

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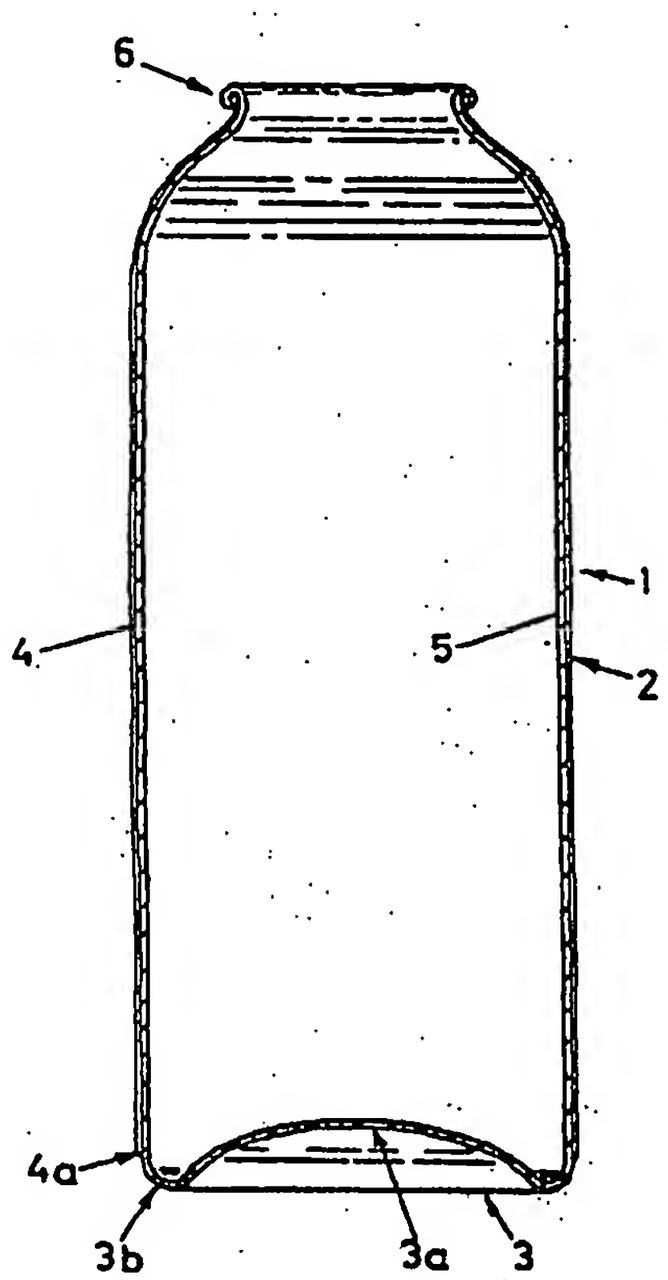
(52) **U.S. Cl.** **413/2**; 29/429; 29/469

(57) **ABSTRACT**

A can body with a jacket-like closed wall and a base constructed on one end of the can wall includes an external base covering in the form of a sheet material. The base covering is fixed into position on an annular connection region of the can body. The base covering can form a basically flat imprintable region in a main region that is surrounded by the connection region. If a bar code can be applied in this imprintable region, then a restriction of the configuration possibility of the can wall disappears. The base covering can form a stand region whereby a standing can body is only in contact with the support surface if necessary via the base covering, and consequently the occurrence of corrosion problems is prevented. A retaining device that leaves the base of a held can body free and a position fixing apparatus are used for fixing the base covering into position. A decorative foil on the exterior of the can wall can be overlapped by the base covering, which serves to prevent a detachment of the decorative foil on the base.



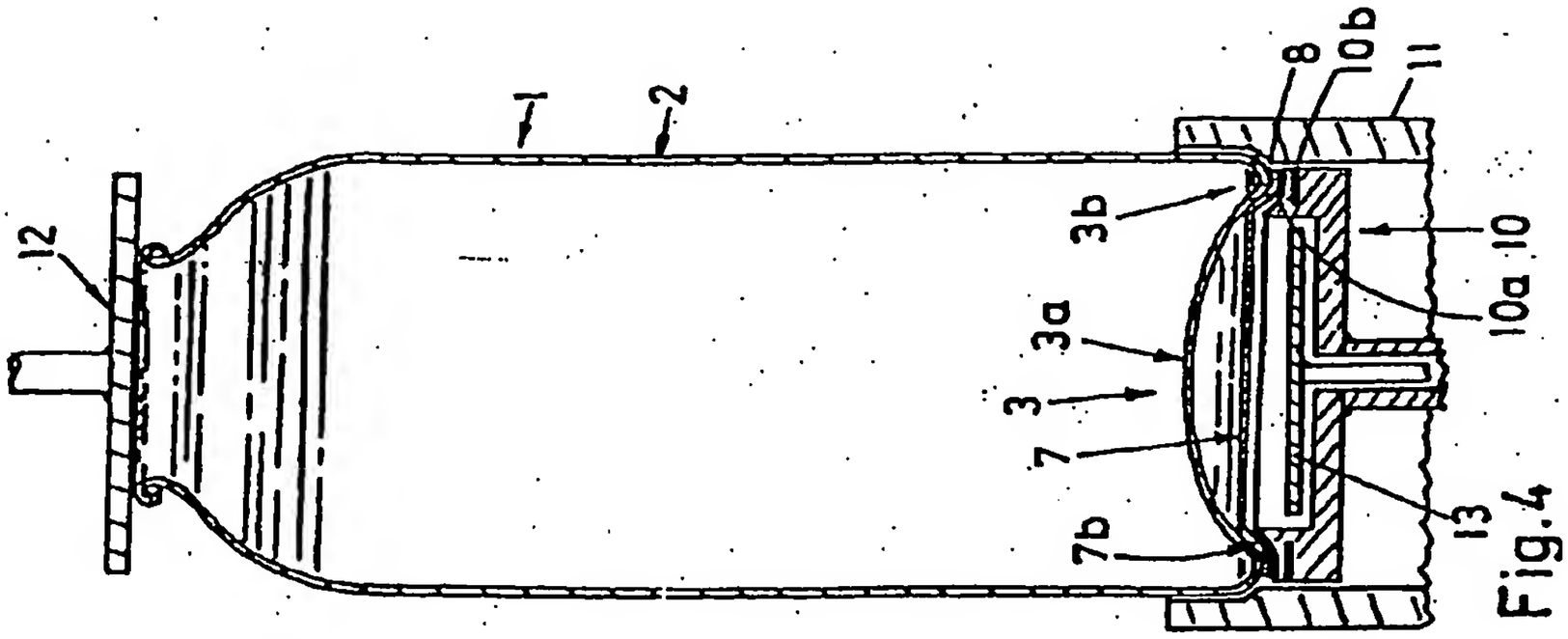


Fig.4

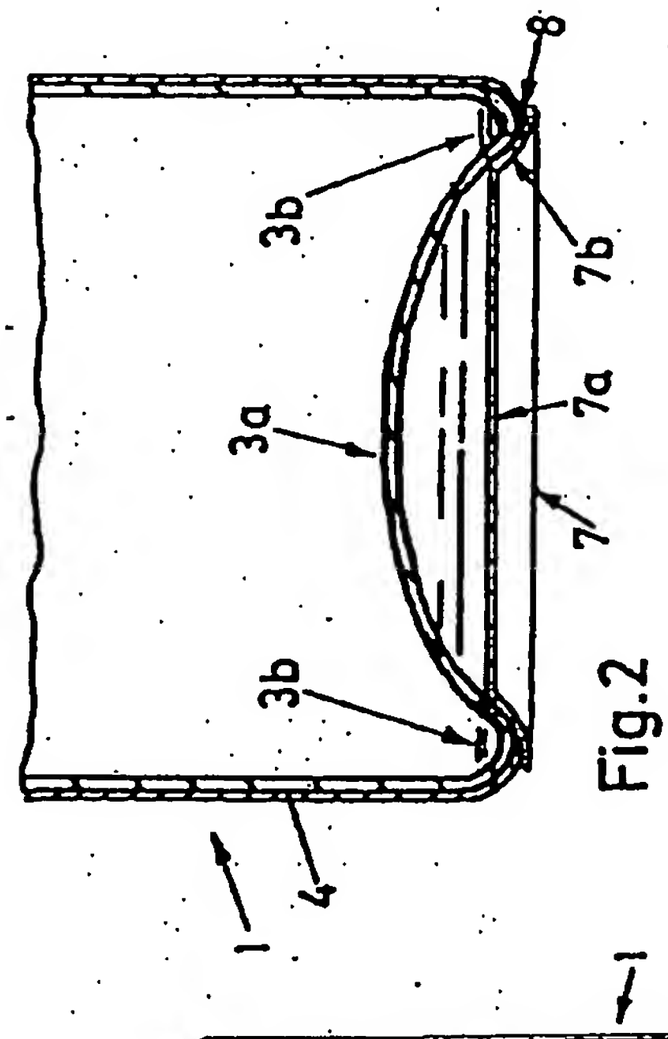


Fig.2

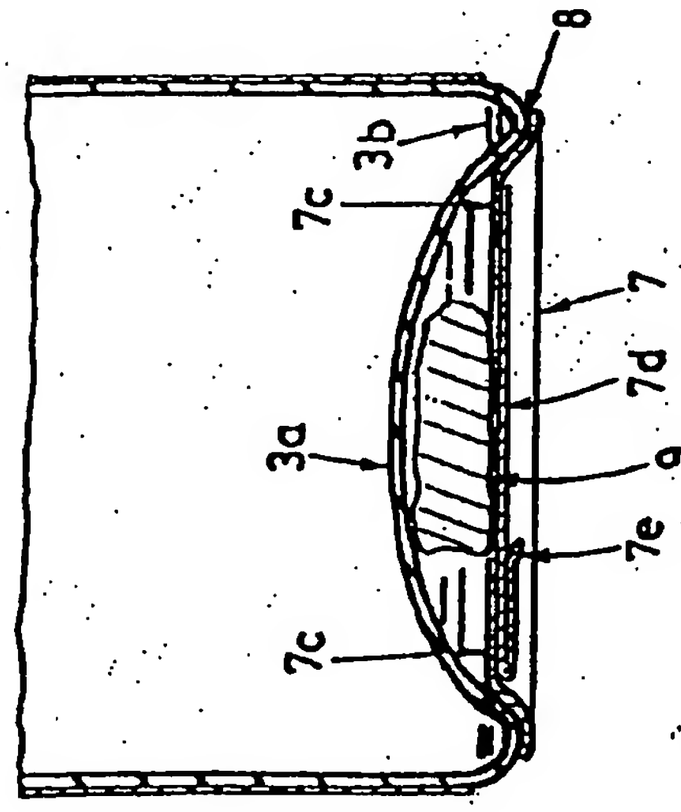


Fig.3

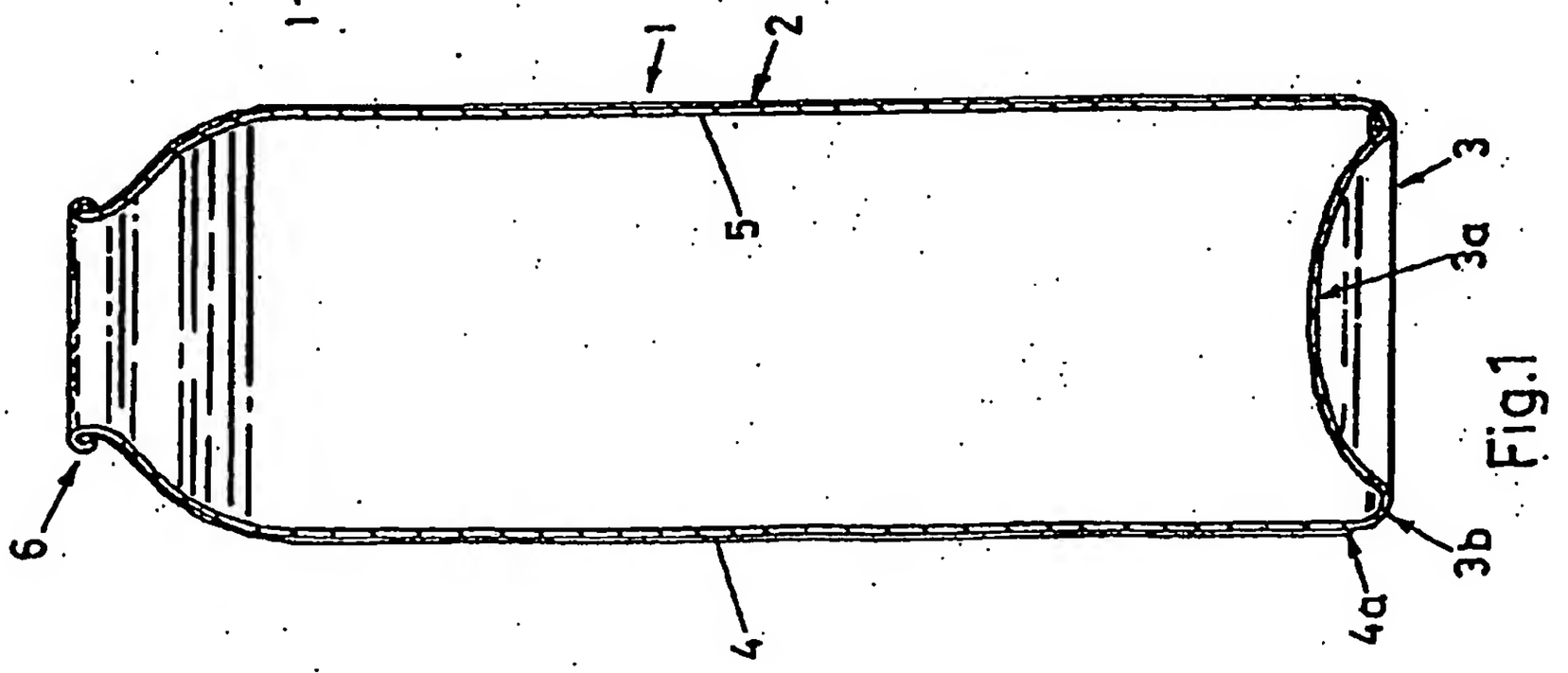


Fig.1

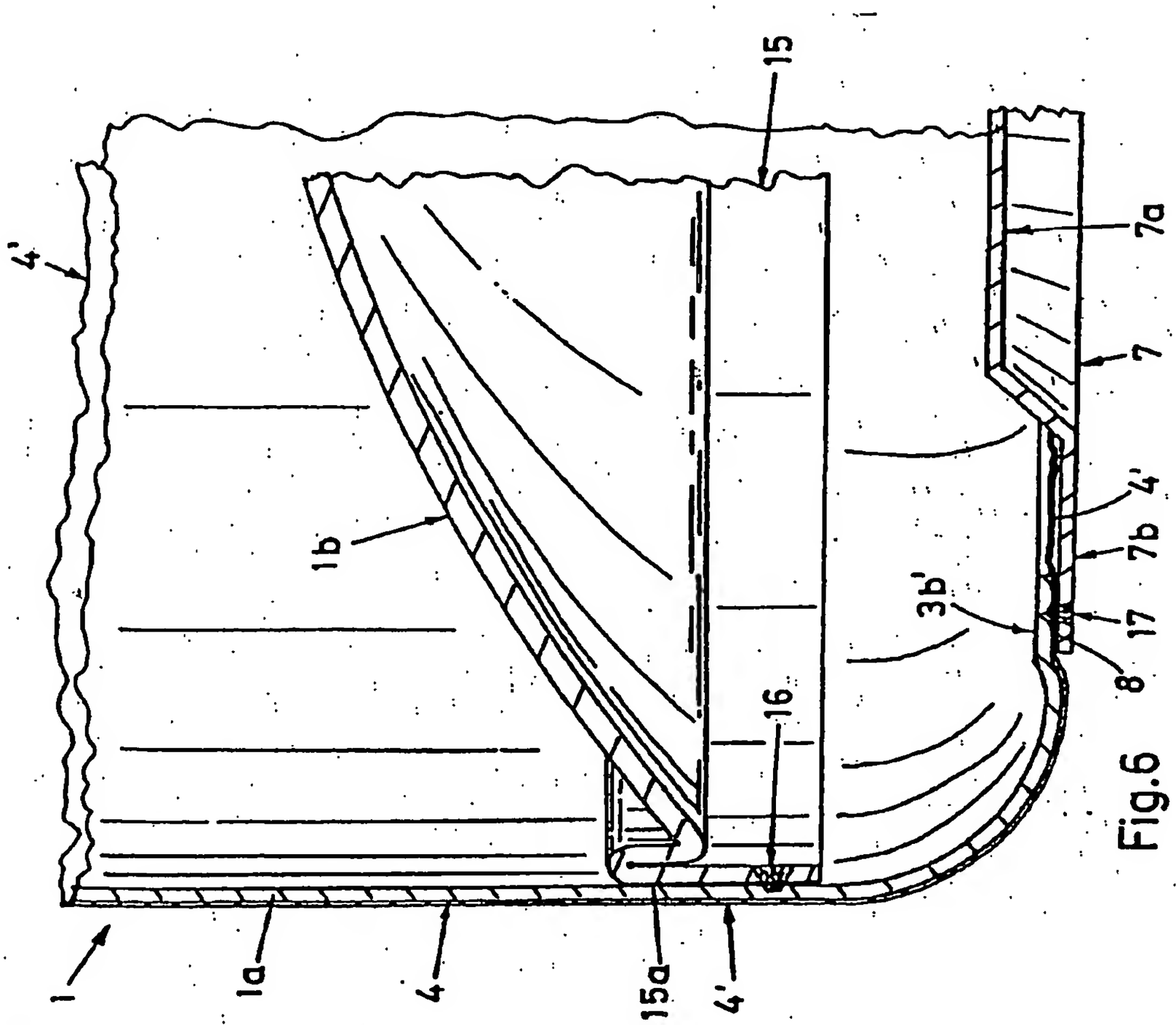


Fig.6

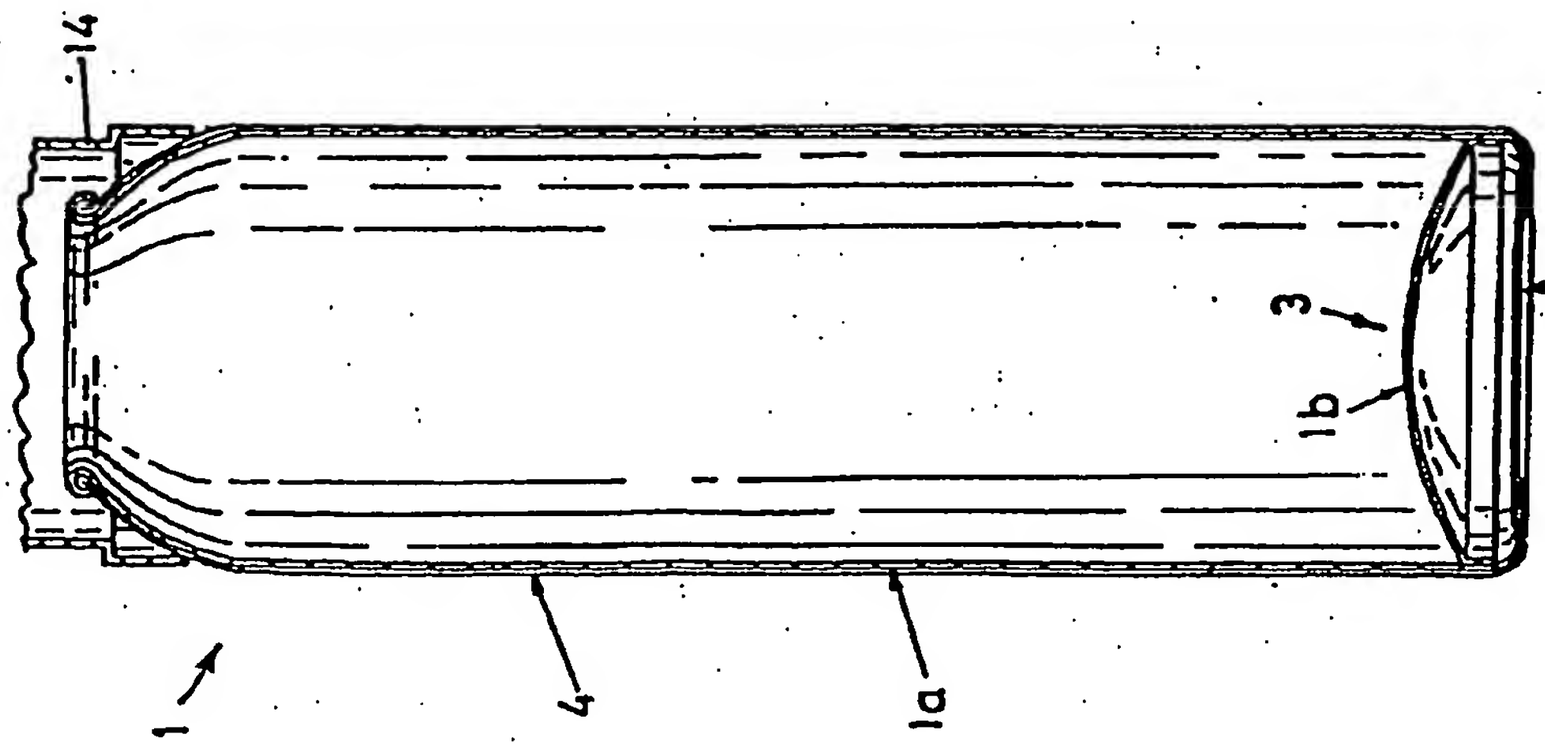


Fig.5

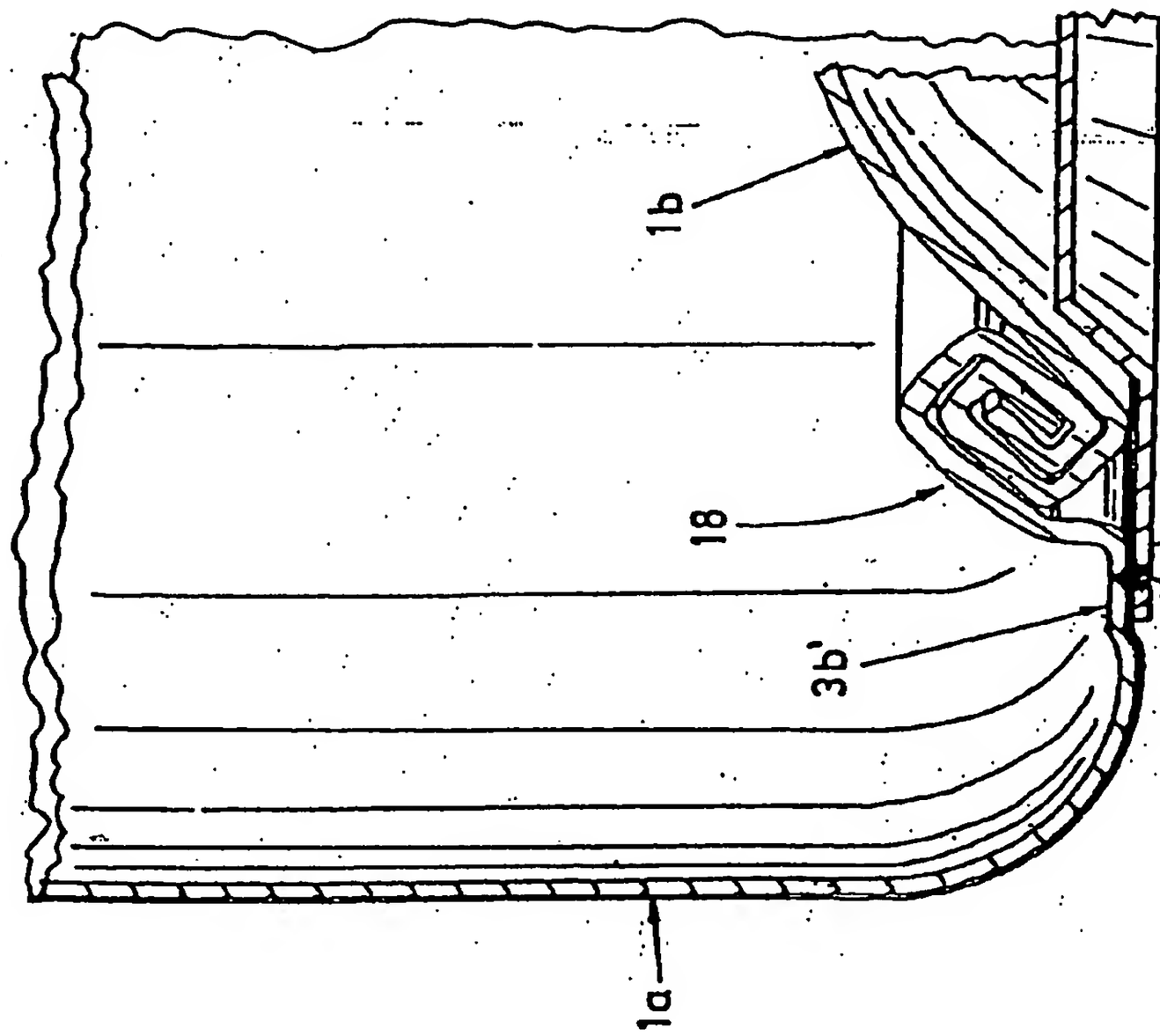


Fig.8

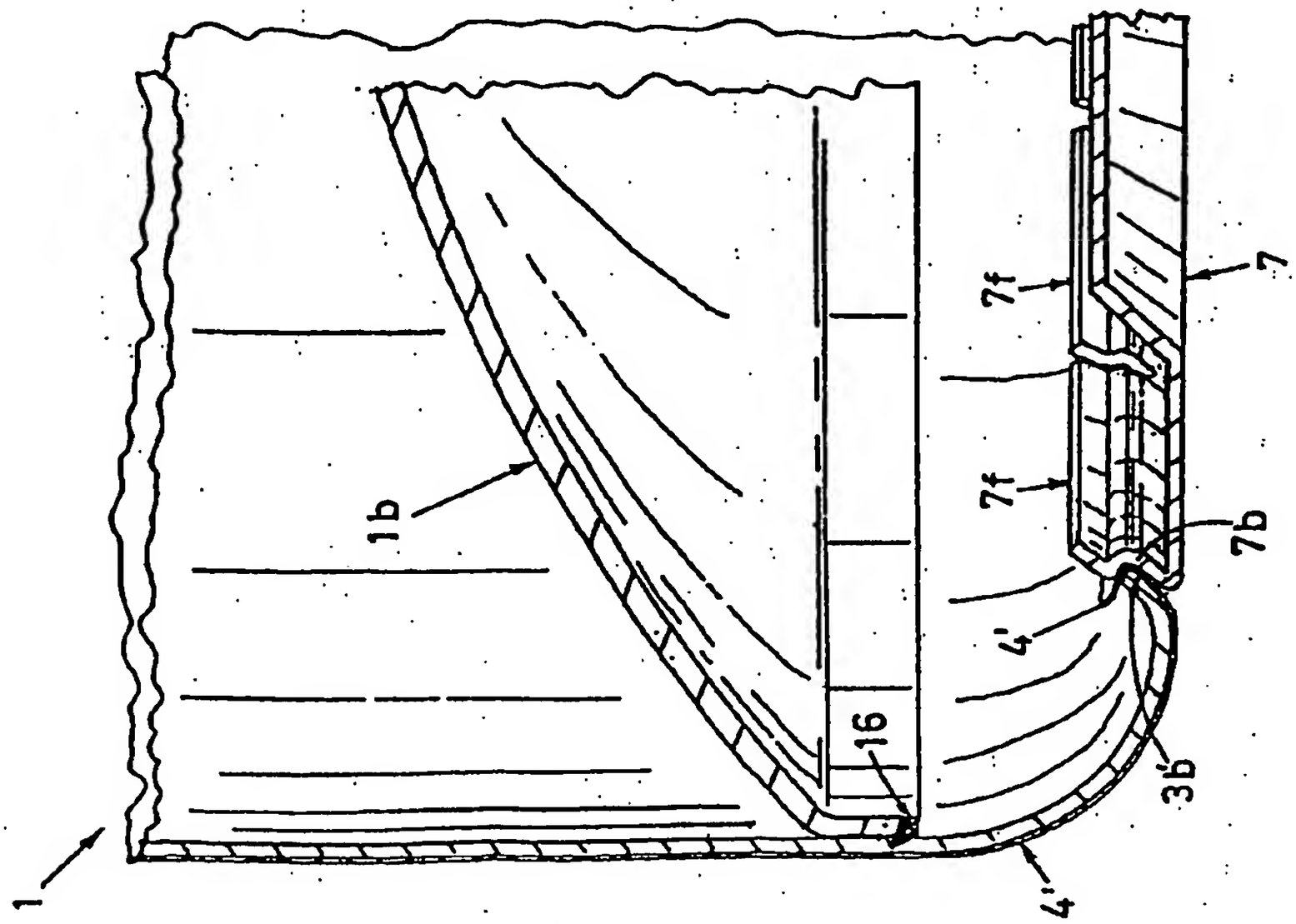


Fig.7

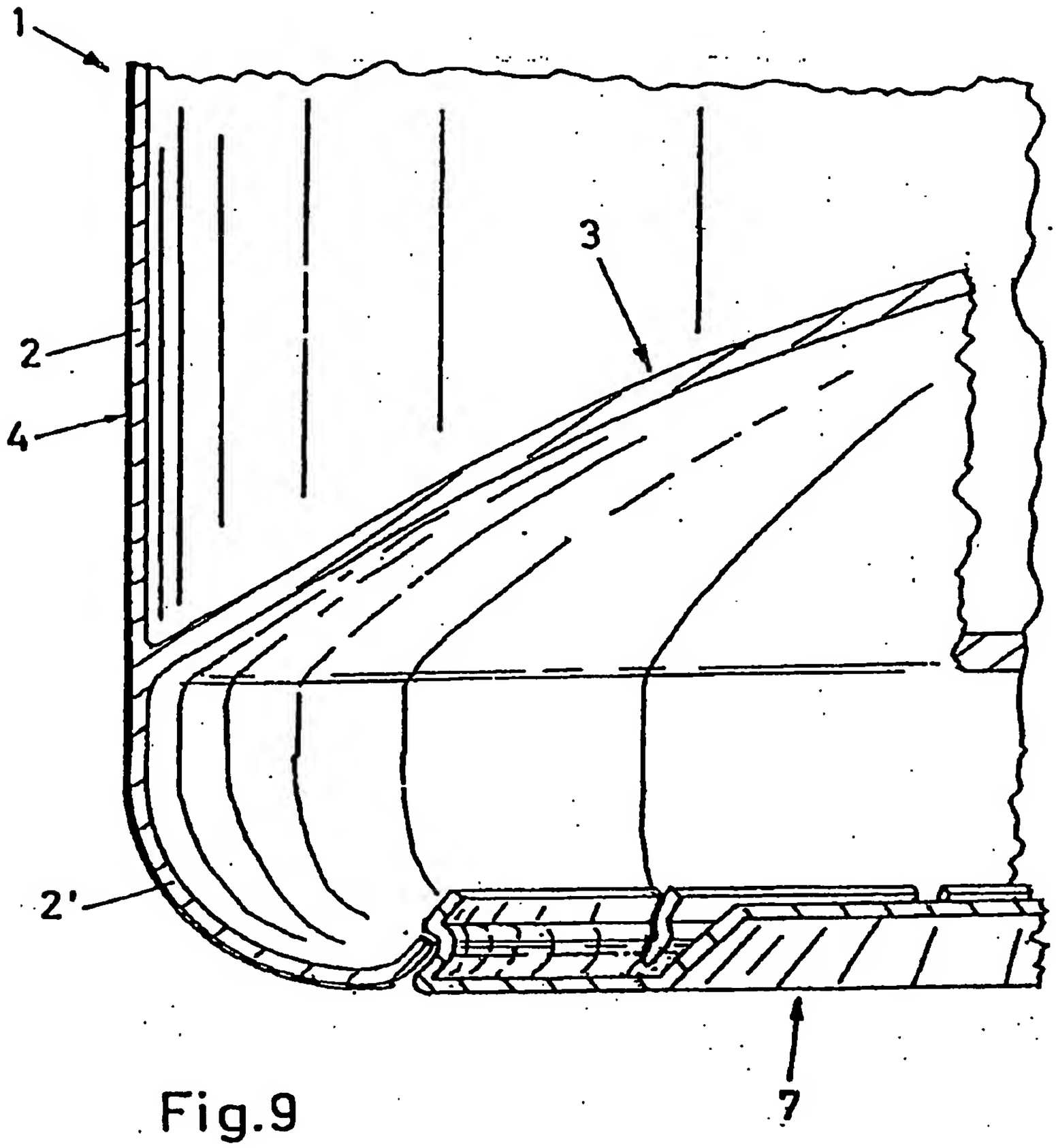


Fig.9

METHOD AND DEVICE FOR THE PRODUCTION OF A CAN BODY, AND CAN BODY

[0001] This application is the national phase under 35 U.S.C. § 371 of PCT International Application No. PCT/CH02/000609 which has an International filing date of Nov. 13, 2002, which designated the United States of America and which claims priority on Swiss Patent Application number 158/02 filed Jan. 30, 2002, the entire contents of which are hereby incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The invention generally relates to a can body, to a method and to a device. The invention concerns vessels or cans which include a base on one end face of a jacket-like closed wall, and of which preferably at least one layer of the wall and the base is made of metal.

BACKGROUND OF THE INVENTION

[0003] Vessels may be formed, for example, as aerosol cans or as beverage cans. Further, cans may be made of aluminum as well as of sheet steel. In order to give the vessels a desired appearance and to apply the necessary information, the jacket-like wall is provided with decoration and labeling. The decoration is, for example, directly printed onto the can. If need be, however, the decoration can be printed onto labels or foils that are then applied to the can wall.

[0004] One printing cylinder must be used per color with the current printing method. The printing costs correspondingly increase with each color required. In addition to decorative or graphically configured labelings, standardized information, such as perhaps a bar code, information on hazards and the composition of the product, and if need be promotional information, must also be applied to the can wall. Moreover, a bar code with a dark color, preferably black, must be printed on a bright background, preferably white, which strongly impairs the aesthetic effect of the decoration, especially with dark overall surfaces.

[0005] Furthermore, usually two additional colors with the corresponding printing costs are needed for the bar code. Only the precise number of cans that are to be brought into commerce with the current bar code or the current advertising information may be manufactured. In the event that the same can is to reach the market at another point in time with another bar code, then additional cans with the old decoration and the new bar code or new advertising information must be manufactured. If need be, a label with the new bar code can be manufactured, which is glued over the old bar code or the old advertising information, which is associated with much expenditure and is not aesthetically satisfactory.

[0006] It is likewise aesthetically unsatisfactory that in cans having a curved transition region from the can base to the can wall the decoration cannot be printed on in the transition region after the base is formed, which, when the can is standing on its base is manifest as an unsightly or not printed lower edge.

[0007] Due to lower manufacturing costs, today more and more products are being sold in cans made of sheet steel. It has now been found that such sheet steel cans rust on the base, especially when used in wet cells. The cans may stand over long periods of time with their annular support surfaces on a wet surface, or if worst comes to worst, on surfaces that are contaminated with other substances. Moreover, moisture and materials added to this as well as electrical effects can bring about corrosion.

[0008] Even with sheet metals that are provided with a thin chromium layer, undesired oxidation has already been observed. The corrosion leads to a contamination of the surface on which the can is standing, and weakens the base of the can. A weakened can base is dangerous in aerosol cans, especially when butane or propane is used as the propellant gas.

[0009] In order to be able to withstand the pressure in the interior of the can, aerosol cans have a base that is arched toward the can's interior. This base is constructed via a pressing process and includes an inwardly arched central region and a downwardly projecting annular edge region where the can base transitions into the can jacket. The cans stand on the annular edge region that can be weakened by corrosion along the support line so that the central region of the base could break out. With can materials having a thin chromium layer, the chromium layer along the support line can be damaged or eliminated by rubbing motions on conveyor facilities of the filler so that corrosion protection is absent to some extent in the corrosion-endangered edge region. Cans whose bases are connected to the jacket via a fold have a narrow, annular downward standing rim that can be easily damaged or oxidized. Corrosion and possibly other chemical and electrical effects can lead to undesired discolorations of the surface on which the can stands.

[0010] Solutions are known from the publications EP 200 098 A2 and EP 208 564 in which elements of two-part and multiple part cans are joined with laser beams. Here the elements to be joined are arranged butted, overlapping and also running toward one another at right angles. The laser welding seam is formed for example on the end face, penetrating one layer or as a flat-lap weld. The solutions described are not aesthetically attractive and cannot prevent a possible corrosion of the base.

[0011] From U.S. Pat. No. 4,455,850 a beverage can is known in which the central inwardly arched region of the base is coated with a dull color. In this manner, sunlight is prevented from being focused by the concave can base, which could cause a fire to be ignited by cans thrown away outdoors. The coating does not extend over the annular transition region so that the corrosion problem is not solved.

[0012] Moreover, the paint is sprayed onto the flat sheet metal so that when stamping out the sheet metal disks and deep drawing the cans, care must be taken that the applied round paint spots are struck exactly centrally by the stamping tools, which is associated with an increased manufacturing expenditure. Even if the paint were to extend over the annular transition region, the paint layer would no longer be continuous after deep drawing the can and pressing the base. Also, rubbing the transition region on conveyors of filling assemblies would lead to damage of the paint layer. Without a continuous paint layer, the already mentioned danger of corrosion exists once again.

[0013] A beverage can is known from U.S. Pat. No. 5,992,892 in which information is printed on the central inwardly arched region of the base that is covered with a

coating that can be rubbed off in the finished can. This solution makes possible an advertising game in which the buyer of a can can determine, after rubbing off the layer, whether he/she has won anything in accordance with the information lying under it. The annular transition region with the supporting ring thus remains without coating, hence the corrosion problem is not solved. Moreover, the rubbed off coating, or the coating that can be worn off, is not suited for continuously coating the support ring. The removability of the coating is crucial for the promotional game.

[0014] U.S. Pat. No. 6,073,797 discloses a cover that is engageable in connection with the upper end face with the aperture to a beverage can. In order that the top remains locking on the can, an outwardly projecting annular region must be provided on the can end, via which a corresponding elastic annular region of the cover can be inverted until it locks. Such a top is very expensive to manufacture and install. Moreover it cannot be installed on the can base due to the lack of an outwardly projecting annular region.

[0015] A further cover that is installed by screwing only at the opening of a beverage can is known from U.S. Pat. No. 5,711,447. The screw lock of this cover requires outwardly projecting ribs on the beverage can that can interact with inward-standing elements on the cover. The features necessary on the can and on the cover for use of the cover are extremely expensive to manufacture. It is also very expensive to screw the cover onto the can. Therefore, the possibility of arranging a promotional article in such a screw lock is associated with an excessive expenditure.

SUMMARY OF THE INVENTION

[0016] An embodiment of the present invention is based upon the task of finding a simple solution for a can that can advantageously be aesthetically configured without being impaired by a bar code or advertising information. In particular, a possible corrosion on the base is to be prevented.

[0017] In one embodiment, it was recognized in accomplishing the objective that corrosion problems and aesthetic problems can both be solved by applying an external covering in the form of a sheet material. The sheet material is fixed in position on an annular connection region of the can body. If the connection is formed along a closed circular line, the membrane-like base covering receives a high level of stability.

[0018] The base covering is basically constructed flat in a main region that is surrounded by the annular connection region and preferably includes the printout of a bar code. If the bar code can be applied on a basically even base surface, then the impairment of the possibility of designing the can wall disappears. No printing rollers for the bar code are necessary for printing the decoration on the can wall. Large amounts of can bodies with an attractive standard decoration on the can wall can be manufactured. Possibly changing information, or information that is not identical for all countries, such as the bar code or even the filling date, and/or aesthetically disturbing information are printed on the base covering. These potentially different base coverings can be printed shortly before the filling time of individual product batches, and can be fixed into position on the standard of the can body. In this way, the same can can be used for all countries and filling batches.

[0019] Because the base covering can be constructed flat in the region of the bar code, the bar code is more readable than a bar code that is applied to curved can wall. If the coating of the exterior of the can wall extends up to the outer edging of the base covering in the form of at least a paint layer or a decorative foil, then a metallic edge becoming visible on the lower can edge can be prevented. The base covering may cover an annular downward-projecting stand region of the can body, thus preventing the occurrence of corrosion problems.

[0020] The base covering is preferably constructed in the form of a sheet plastic material. It is obvious that sheet material having at least one metal layer, especially an aluminum or steel layer, or even with a cardboard layer, can also be used. Here the stability-imparting layer may also be coated with plastic.

[0021] The sheet materials that are used should guarantee a robust base covering that will not be damaged on the conveyor apparatuses of filling assemblies and also will remain as constant as possible even when standing on wet supports. The aforementioned sheet materials can all be provided with a sealing coating and consequently can be sealed on the base. When metal foils are used, the heat required for the sealing process can also be introduced inductively. A latching connection or a welded connection can also be used instead of a seal connection for fixing the base covering into position, especially with at least three laser welding points.

[0022] It is obvious that the base covering of an embodiment of the invention is not restricted to use in cans. There are also vessels, especially plastic bottles, the bases of which include an annular downward projecting base region and on which consequently a base covering can be fixed. Although there exists no danger of corrosion with plastic vessels, the use of base coverings for the placement of bar codes and advertising information on vessel bases is advantageous.

[0023] If a decorative layer in the form of at least one paint layer, but preferably as a decorative foil, is applied on the exterior of the can wall, then the base covering can be constructed such that the decorative layer extends at least to the outer edging of the base covering. Preferably, however, the decorative layer is somewhat overlapped by the base covering. This prevents foils from being able to loosen on the end region of the can body when decorative foils are used.

[0024] When decorative foils are used, a can body with a can wall and base can be manufactured economically corresponding to the respective requirements. If need be, a decorative foil can be subsequently applied to the can wall so that imprinting the can body can be dispensed with. If the can wall and base are pressed from a single element, as perhaps with aerosol cans made of aluminum or with cans made from steel sheets, then the necessary intensive cleaning and drying for imprinting can be dispensed with. A peeling of the foil can be ruled out with foils closed in the peripheral direction that are overlapped by the base covering. If the can body is assembled from a jacket and a base, these two parts may be joined to one another via a folded seam, but preferably a welded seam, especially a laser welded seam. A decorative foil is preferably applied after this joining step, wherein preferably a close and in particular firm application of the foil on the can body can be guaran-

teed by using a shrinkable foil, especially with a sealing layer that faces the can body. If the can jacket and base are joined using a folded connection, then the folded connection may also be made after the decorative foil is applied, whereby then the folded seam would take over holding the foil on the lower end of the can.

[0025] The base covering, or if need the decorative foil as well, permits a covering of the connection between the jacket and base so that no high aesthetic standards must be imposed on this connection. When a welded seam or laser connection is used, the annular connection region is preferably formed by an end region of the can jacket projecting over, the base, wherein this end region is drawn especially somewhat toward the can axis and forms the annular transition region. With a folded seam, this can be constructed in the region of the can base and if need be can be pressed toward the interior of the can such that a curved jacket end region can be used as an annular connection region. With these described variants, a base covering that is fixed into position on the annular connection region bridges the respective connection seam

[0026] In order to produce an aesthetically attractive can body, the transition from the can wall to the base covering is constructed circular segment-like in longitudinal section, whereby it preferably has a curvature radius ranging from 1 to 6 mm, especially basically 3 mm.

[0027] Thanks to the base covering it is now possible, for example, to furnish a two- or three piece aerosol can of sheet steel that has the appearance of a one-piece aluminum can. The possible embodiments in the base area have already been described above. In order to form the valve seat on the upper end face of the can, a compression necking process can be provided in the case of a two-piece can, and the use of an upper end piece with valve seat in the case of a three-piece can.

[0028] Obviously the invention includes all solutions resulting from the combination of the features and embodiments described. Varying the features includes, for example, choosing between one-, two- or three-piece cans, with two- and multiple-piece cans, the choice of various modes of connection between the parts, providing or omitting a decorative foil, the choice of a specific base covering and its fastening on the can body as well as the selection of material for the can and the base covering. Even unexpected combinations can lead to advantageous solutions. Thus, for example, a one-piece aluminum can with a base covering that includes magnetizable sheet steel has the advantage that this can can be conveyed via magnetic conveyors while using magnetic forces of adhesion with various axis alignments.

[0029] The possibility of clamping a decorative foil firmly on the lower can end with the base covering opens up a many sided use of decorative foils. These foils are imprinted when needed on their exterior, but preferably on the side facing the can body. The printed layer is protected with a transparent foil that is imprinted on the reverse side, or on the side facing the can body, so that no friction-conditioned impairments of the decoration can arise. A transparent foil printed on the reverse side can be provided with a sealing layer after imprinting through the printed layer, which also guarantees a seal connection between the foil and the can body. In order to be able to shrink the foil on the can body, a piece of foil is shaped in a first step into a closed foil jacket and joined together on the two side lines allocated to each other, whereby preferably a seal connection is created. This foil jacket has a slightly greater cross section than the can body and can thus be inverted over the can body and shrunk on the latter as well as sealed fast with the application of heat. After applying the decorative foil, the base covering is fixed into position such that it somewhat overlaps the foil end on the base. It is obvious that the base covering can also be constructed annularly so that it holds the end of the foil securely on the can body but does not completely cover the can base.

[0030] Applying foils to a can body is known, for example, from EP 1 153 837 A1, wherein however there with each foil segment, the printed layer may not be applied up to the foil edge, respectively a blank foil edge is needed. In accordance with this known solution, a sealing layer arranged between the foil and the printed layer must lie open when constructing the closed foil jacket to generate a sealing seam. Therefore the imprinting and the succeeding cutting of the foil track must be exactly harmonized with each other, which is not attainable with simple expenditure with a thin foil due to its elastic deformability. In this connection the present invention provides a simplification. Because a sealing layer is applied to the printed layer, the printed layer can be constructed continuously. Cutting the pieces of foil need not precisely agree with the printing, and the formation of a sealing seam is always guaranteed.

[0031] A sufficiently shrinkable foil can guarantee that the decorative foil lies free from folds on the body after the shrinking process in the drawn-in base region, and if need be also in a drawn-in upper end region. Because weld seams and especially laser connections can be constructed such that the surface of the can body is basically smooth even in the region of the seam, it can no longer be recognized after applying the decorative foil and the base covering that the can body was brought into the desired shape using seams. With cylindrical can bodies, a rectangular sheet is shaped into a can jacket with a longitudinal seam. But it would also be possible to assemble the can jacket out of two or more jacket pieces with two or more longitudinal seams so that if need be a jacket deviating from the cylindrical shape arises. The deviation from a circular cylindrical shape can arise in the cross section as well as in the longitudinal direction.

[0032] In order to be able to hold a decorative foil extremely securely on the can body even on the upper end of the can, an annular covering element is also provided there. This upper covering element is formed in connection with aerosol cans if need be from a sub-region of the valve or from a part fastened onto the valve seat. It is obvious that it can also be fixed in position on the upper end of the can analogously to the base covering through a seal connection, a latching connection or a welding connection, especially with at least three laser welding points, wherein this part covers the upper foil end and therewith protects it from tearing off.

[0033] Covering the foil end on at least one end of the can, especially below, makes it possible to dispense with cutting the foil or foil jacket exactly to size in the direction of the axis of the can without in this way an unsightly end being able to make an appearance. Moreover, folds that could form on strongly necked end regions are covered by the base covering and/or by the annular covering element.

[0034] Embodiments should also be included in which the base covering lies directly on the base with a surface adapted to the shape of the base and is in particular sprayed directly on the base as an injection molded component.

[0035] The solution of the embodiments of the invention opens up new configuration possibilities for cans. Moreover, simplifications in can manufacturing result, allowing the cans to be assembled directly at the filling site. This has the advantage that the space-consuming transport of empty cans from a facility for manufacturing cans to the various filling facilities can be dispensed with. The cans are, for example, assembled from a flat sheet metal piece from which the jacket is formed, from a base component, an upper end component, and a base covering, along with a decorative foil. The base elements, the upper end elements and the base coverings can be stacked with little free space and can consequently be transported in a space-saving manner like stacks of pieces of sheet metal and foil rolls.

BRIEF DESCRIPTION OF THE DRAWINGS

[0036] Further advantages, features and details of the invention will become evident from the description of illustrated exemplary embodiments given hereinbelow and the accompanying drawings, which are given by way of illustration only and thus are not limitative of the present invention, wherein:

[0037] FIG. **1** illustrates a vertical section through an aerosol can in accordance with the state of the art,

[0038] FIG. **2** Illustrates a cutaway of a vertical section through an aerosol can with a base covering,

[0039] FIG. **3** Illustrates a cutaway of a vertical section through an aerosol can with a base covering and an advertising article

[0040] FIG. **4** illustrates a vertical section through an aerosol can and a device for applying a base covering,

[0041] FIG. **5** Illustrates a vertical section through an aerosol can with a base covering, wherein the can body is assembled from three parts,

[0042] FIG. **6** Illustrates a detailed cutaway from the base region of a can in accordance with FIG. **5** with a base covering that is fixed into position using a sealing or welding connection,

[0043] FIG. **7** Illustrates a detailed cutaway of a can with a base covering that is fixed into position using a latching connection,

[0044] FIG. **8** Illustrates a detailed cutaway of a can with a base covering, wherein can base and jacket are connected through a folded connection, and

[0045] FIG. **9** Illustrate a detailed cutaway of a one piece can with a base covering that is fixed in position using a latching connection.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0046] FIG. **1** illustrates a can body **1** in accordance with the state of the art with a jacket-like closed can wall **2** and a base **3** on the lower end face of the can wall **2**. This is an aerosol can whose base **3** is arched with a central region **3***a* against the can interior. A downwardly projecting annular edge region **3***b* is formed around the central region **3***a*. The cans stand on a support line of the annular edge region **3***b* wherein the support line can be weakened by corrosion so that the central region **3***a* can break out. The can wall and the base include a metal layer **5**. A decorative layer **4** is arranged on the exterior of the can wall **2** or at the metal layer **5** that extends from a valve seat **6** through a conified neck and the predominant region of the can wall **2** up to the transition wall from the can wall **2** to the base **3**. An uncoated can region is visible beneath the lower edging of the decorative layer **4**.

[0047] FIG. **2** shows a preferred embodiment of an aerosol can **1** with an external base covering **7** in the form of a plastic sheet material that is fixed to a downward projecting annular edge region **3***b* of the base **3** with a seal connection **8**. The edge region **3***b* consequently forms a connection region on which the base covering **7** is fixed into position. The base covering **7** includes a contact region **7***b* that lies on the edge region **3***b*. The seal connection **8** extends at least over a sub-region of the contact region **7***b* and is preferably formed by a sealing layer arranged on the base covering **7** that was sealed by a sealing apparatus to the edge region **3***b*. It is obvious that the connection between the edge region **3***b* and the contact region **7***b* can also be attained with an adhesive.

[0048] The decorative layer **4** can be constructed as a coating on the exterior of the can wall **2** in the form of at least one layer of paint as well as in the form of a decorative foil. The decorative layer **4** extends preferably at least up to the outer edging of the base covering **7**. In the embodiment represented, the decorative layer **4** is somewhat overlapped by the base covering **7**. In this way, the metal layer **5** can be prevented from being accessible in the base region. A danger of corrosion is consequently ruled out. The flat sheet material of the base covering **7** has a layer thickness of at least 0.02 mm, preferably, however, in the range from 0.08 to 0.8 mm, especially from 0.2 to 0.6 mm. In this way, the strength necessary for different mechanical stresses can be guaranteed.

[0049] The base covering **7** includes a main region **7***a*, surrounded by the contact region **7***b* or by the inner edging of the seal connection, that is basically constructed flat and in particular includes the printout of a bar code. The base covering **7** includes a tear-apart device if need be that is constructed somewhat in the form of a weakened tear apart line in the main region **7***a*. By tearing along the tear-apart line using a strap, a part of the main region **7***a* of the can can be removed or at least swung out. Winning information can be applied on the interior surface of this element that becomes accessible via the tearing. A base covering **7** that can be torn off enables effects that permit advertising.

[0050] FIG. **3** illustrates a base covering **7** with a first and a second covering element surface **7***c* and **7***d*, wherein the first covering element surface **7***c* is connected via the seal connection **8** with the edge region **3***b* of the base **3**, and the second covering element surface **7***d* is fixed into position separably on the first covering element surface **7***c*. In order to be able to separate the covering surface **7***d*, a grasping strip **7***e*, for example, is constructed on the covering element surface **7***d*. If the first covering element surface **7***c* has an opening in the central region, an advertising article **9** arranged between the central region **3***a* of the base **3** and the

base covering 7 can be removed after separating the second covering element surface 7*d*. The base covering 7 makes possible numerous advertising effects. The covering subsurface 7*d* can, for example, be constructed as a collection piece that has on the one side a motif or an image and if need be a designation for it on the other side. The advertising article 9 and/or the covering subsurface 7*d* can include collection points, good luck sayings or even recipes. If beverages are poured into the can body, a beverage additive, such as perhaps vitamins, alcohol, stimulants or sweeteners, may be arranged in the hollow space between can base and the base covering instead of the advertising article. It would also be advantageous to sell medications directly with water, wherein the medication would be arranged between the can base and the base covering of the vessel with the water.

[0051] FIG. 4 shows a device with which the base covering 7 can be sealed fast to the downward projecting annular edge region 3*b* of the base 3. The device includes a retaining apparatus for retaining the can body and a sealing apparatus 10 with an annular sealing surface 10*a* that is adapted to the edge region 3*b* of the base 3. In order to heat the sealing surface 10*a* to a desired temperature, the sealing surface 10*a* is allocated a heating device 10*b*. The heating apparatus must be constructed such that the sealing surface 10*a* is movable relative to the base 3. In the embodiment represented, the retaining apparatus includes a centering apparatus 11 that extends ring-like around the sealing apparatus 10 for accommodation of the can base 3 and a hold down apparatus 12 that in interaction with the sealing apparatus 10 makes attainable the desired contact pressure between the base covering 7 and the base 3 of the can body 1. In order that the base covering 7 does not need to be moved by the heated sealing apparatus 10 to the base 3, the sealing apparatus 10 preferably includes a feeding apparatus 13 that is movable relative to the sealing surface 10*a*.

[0052] In accommodating a base covering 7 that can if necessary be fed in from the side, the feeding apparatus 13 is arranged over the sealing surface 10*a*. After a can body 1 is inserted into the centering apparatus 11, the base covering 7 is moved by the feeding apparatus 13 toward the base 3. Subsequently the annular sealing surface 10*a* presses the contact region 7*b* against the edge region 3*b* until the heat administered has attained the desired sealing connection 8. It is obvious that the retaining apparatus and the sealing apparatus can be configured in accordance with solutions from the state of the art. In particular, it would also be possible to provide a retaining device that retains the can body solely from an end face and/or holds the latter with the base upward.

[0053] In order to implement the sealing connection between the can base and the base covering, at least one processing station is provided, which preferably includes a rotary table, to which is allocated sealing apparatuses rotating along with it. In this manner, the sealing can be conducted during the rotary motion of the rotary table. Such a processing station can, for example, be arranged in the filling operation before or after filling.

[0054] FIG. 5 shows the can body 1 of an aerosol can 1, wherein the can body 1 is assembled from a jacket element 1*a* and a base element 1*b*. The view of the connection between the base element 1*b* and the jacket element 1*a* is covered by the base covering 7. The jacket element 1*a* is provided with a decorative layer 4 that if necessary can be printed directly onto, the cylindrical can body. If the jacket element 1*a* is made out of a sheet of metal by transformation and application of a welded seam, then the decorative layer 4 can also be previously printed upon the flat metal sheet. A valve seat is constructed at the upper end of the can body 1 by die necking and transforming the opening into a valve seat. If need be, a decorative foil is shrunk on directly after the necking, basically extending to the end corner of the jacket element 1*a* so that the end of the foil is clamped after transforming by the transformed can edge.

[0055] If the decorative labor 4, especially the decorative foil, does not extend to the upper edge of the can, an upper covering element 14 can be arranged on the upper end of the can, at least covering the can end region without decorative layer. If the can body is made of three parts, an upper end piece with the valve seat must be fixed into position on the jacket element 1*a*. In accordance with the state of the art, this is done with a folded seam or if need be via welding (EP 208 564 B1). The unattractive seam region thereby arising between the upper end element and the jacket element 1*a* can be covered by the upper covering element 14. In the case of an aerosol can, the upper covering element 14 is an element that is connected to the valve and always rests on the can following insertion of the valve. By providing covering elements 7, 14, three-piece cans can be furnished in which the consumer cannot recognize that the can body 1 is composed of various parts. Basically all known types of connection for tightly connecting can elements can be used.

[0056] In the embodiment in accordance with FIG. 5, the base element 1*b* is connected via an annular welding connection to the jacket element 1*a*. On the base, an edge region of the base element 1*b* extends along the jacket element 1*a* adjacent to the lower edge of the jacket element 1*a*. The welding connection can be made in the form of a fillet seam or also in the contact region of these two elements by penetrating one element. It is obvious that the elements can also be butt welded, that at least one of the two connections could be constructed as a folded connection, or that a connection is provided only below or only above. Without using an upper end piece, the jacket element 1*a* must be strongly necked to form a valve seat, which is for various materials associated with great expenditure, especially with many die necking steps, and in the worst case with insurmountable problems. Due to the covering possibility, an optimized assembly of the can body can be selected without it appearing negative in appearance.

[0057] If the can body is provided with a decorative foil, the base covering 7 and if necessary also the upper covering element 14, can be used to protect or firmly clamp the lower or upper foil edge. In this way, the danger of a decorative foil loosening can be substantially reduced. Even welded seams in the longitudinal direction of the can can be covered with a decorative foil. A can jacket that is formed by bending and welding, especially laser welding, can already receive a special shape by cutting the assembled elements to size. Because the material of the at least one metallic sheet material shaped into the jacket is not hardened by transformation steps, the jacket can at least be transformed regionally by altering the periphery. In this way, aesthetically attractive cans can be formed that can be provided with a

shrinking decorative foil before or if necessary after transformation. Consequently, new configuration possibilities result.

[0058] FIG. 6 shows a cutaway from a can body 1 in which a base element 1*b* is permanently welded to the jacket element 1*a*, projecting upward, dome-like. A welded connection 16 is formed between an annular region 15 and a peripheral line of the jacket element 1*a* that, for example, extends through the annular region 15 to the jacket element 1*a* and is preferably generated via laser welding. With aerosol cans, the can interior must accommodate an increased pressure. A fold-like strengthening of the annular region 15 prevents a detachment of the base element 1*b* from the jacket element 1*a*. With an impermissibly high internal pressure, the arching of the base element 1*b* can deform toward the outside and thus indicate the excess pressure as well as prevent a bursting. The base covering 7 includes a main region 7*a* surrounded by the contact region 7*b* that is preferably constructed basically flat and can in particular accommodate the printout of a bar code. In the embodiment represented, the contact region 7*b* is fixed in position on a corresponding annular connection region 3*b*' on the lower end of the jacket element 1*a*. An adhesive or seal connection 8, for example, can be provided for fixing into position. If the material of the contact region 7*b* includes metal, the connection can also be guaranteed by weld points 17, for example at least three laser welding points.

[0059] In the represented embodiment, a decorative layer 4 in the form of a decorative foil 4' is situated on the exterior of the can body 1. The decorative foil 4' is shrunk fast before the base covering 7 is fixed into position on the can body 1. The lower edge of the decorative foil 4' need not be exactly cut to size because it is covered by the base covering 7. It extends at least somewhat into the connection region 3*b*', but can also project somewhat over the edge of the jacket element 1*a*. The seal connection must consequently be at least partially constructed between the exterior of the decorative foil 4' and the contact region 7*b* with a sealed connection between the contact region 7*b* and the connection region 3*b*'. The decorative foil 4' should thus adhere sufficiently well to the connection region 3*b*' For this, sealing layers are present approximately in the connection region on both sides of the decorative foil, which guarantee a fast connection due to the sealing process. The transition from the jacket element 1*a* or from the can wall 2 to the base covering 7 is constructed in the form of a circular segment in longitudinal segment or is drawn in toward the interior and preferably has a curvature radius ranging from 1 to 6 mm, especially basically 3 mm. This radius permits in comparison to corners an unimpeded conveyance even over short steps. If need be, the base covering 7 forms a base wherein a standing can body 1 is only in contact with the support surface through the base covering 7.

[0060] FIG. 7 shows an embodiment in which the base element 1*b* is fastened to the jacket element 1*a* via a welded seam 16 in the form of a fillet seam. The base covering 7 is fixed into position with a latching connection on the lower edge region of the jacket element 1*a*. The connection region 3*b*' is formed by the lower and free edge region of the jacket element 1*a*. The contact region 7*b* of the base covering 7 lies form-locking on the connection region 3*b*' and is preferably formed by spring lips 7*f*, so that the base covering 7 can be inserted under spring deformation of the spring lips 7*f* on the underside of the can body 1. The decorative foil 4' extends between the jacket element 1*a* and the base element 1*b* over the connection region 3*b*' and is consequently clamped fast on the can body 1 by the base covering 7.

[0061] Because it is possible to omit a seal or welded connection, the base covering 7 does not need to be sealable or weldable. Consequently, any desired plastics or even metals, especially coated and/or magnetic metals, can be used to manufacture the base covering. The spring lips 7*f* can be constructed in any desired form and are provided at least at three points basically equally spaced in the peripheral direction. Because positioning a latching element without a sealing or welding device can be conducted by a single linear motion of a pressing element, the method as well as the device for fixing a latching base covering in position are extremely simple.

[0062] FIG. 8 shows an embodiment in which the base element 1*b* is joined to the jacket element 1*a* via a folded connection 18. The folded connection 18 is preferably so constructed and deformed toward the interior of the can that the transition from jacket element 1*a* or from the can wall 2 to the base element 1*a* is in the form of a circular segment in the longitudinal section and includes a connection region 3*b*' for fixing the base covering 7 in place. A sealing or welding connection is constructed between the connection region 3*b*' and the contact region 7*b* for fixing the base covering. The folded connection 18 is covered over by the base covering 7. If necessary a decorative foil 4' extends along the jacket element 1*a* up to under the contact region 7*b*.

[0063] FIG. 9 shows an embodiment in which a can body 1 was constructed using pressing, especially cold impact pressing, such that the base 3 transitions into the upright standing can wall 2 and into a wall segment 2' standing downward. The can wall 2 together with the wall segment 2' will form a cylindrical jacket surface directly after pressing that can, which surface for example, can be imprinted with a decorative layer 4. The wall segment 2' is somewhat drawn in, in order to be able to fix the base covering thereon. In the embodiment represented, the decorative layer extends basically up to the base covering. That means that the entire region of the can body 1 visible from the side has a decoration. If necessary a foil that extends up to beneath the base covering is provided. If the can body is made of aluminum, then a can body that can be conveyed using magnetic conveyors can be furnished by inserting a base covering 7 with magnetizable metal.

[0064] Exemplary embodiments being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the present invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.

1. Method for the production of a can body with a closed can shell and at least one closure member arranged on the can shell, comprising:

forming a metal strip to a tube closed in peripheral direction; a

laser welding a longitudinal seam in between lateral edges of the tube shaped metal strip substantially continuously in longitudinal direction of the tube;

severing tube sections of the obtained tube, which have the length of a desired can height;

forming the sections to shells with a cross-sectional restriction at least at one face of the can shells; and

attaching a closure member in the form of a can bottom to said at least one restriction of each can shell by laser welding a circumferential seam, wherein the outer marginal region of the can bottom is adapted to the shape of said restriction.

2. Method according to claim 1, wherein

the longitudinal seam is welded on a flat pressed tube while the lateral marginal regions to be interconnected are supported on the inner side of the can shell.

3. Method according to claim 1, wherein for forming the tube the metal strip is moved in its longitudinal direction through a forming device and is passed next to a welding device, the forming device forming the metal strip continuously in such a way that the two lateral edges contact each other, and the welding device interconnects these lateral edges by said longitudinal welding seam.

4. Method for the production of a can body with a closed can shell having a longitudinal welding seam extending over the entire height of the can shell and with at least one closure member arranged on the can shell, comprising:

cutting a metal strip into sections,

forming the sections into a closed flat pressed shape by means of a forming mold and forming tools

putting the flat pressed sections in series, joining directly each other

laser welding a longitudinal seam in between lateral edges of the joining, flat pressed sections substantially continuously in longitudinal direction along the joining, flat pressed sections,

severing tube sections, which have the length of a desired can height;

forming the sections to can shells with a cross-sectional restriction at least at one face of the can shells; and

attaching a closure member in the form of a can bottom to said at least one restriction of each can shell by laser welding a circumferential seam, wherein the outer marginal region of the can bottom is adapted to the shape of said restriction.

5. Method according to claim 1, wherein a decorative film is applied to the outer side of the metal strip.

6. Method according to claim 1, wherein a first film strip is put on the flat metal strip in longitudinal direction of the metal strip, and is fixed by way of a sealing connection to form an inner protective layer.

7. Method according to claim 1, wherein for severing tube sections, a cutting procedure is carried out with a cutting edge, the cutting edge, during the cutting procedure, being moved together with the arising tube and being reset after having severed a tube section.

8. Method according to claim 7, wherein on the flat metal strip incisions are formed which after forming and pressing flat are arranged in curved regions between flat regions, the cutting procedure being carried out in the flat regions between the incisions.

9. Method according to claim 1, wherein can shells are shaped by a shell forming device in such a way that a circular cylindrical cross-section is obtained.

10. Method according to claim 9, wherein at least one face side of a circular cylindrical can shell an annular buckle is formed radially outwards, the can shell comprising a cross-sectional restriction towards the face side at the buckle.

11. Method according to claim 1, wherein said at least one restriction is a shoulder-shaped restriction.

12. Method according to claim 1, wherein a cross-sectional restriction is formed at the upper face side of the can shell, and a closure member is tightly connected to the restriction at the upper face side of the can shell by a laser welding a circumferential seam, wherein the outer marginal region of the closure member is adapted to the shape of said restriction.

13. Method according to claim 12, wherein the can body is held in two regions, in a first region by a first holder so that it may be rotated about its longitudinal axis by the first holder, while the second region is situated at the can end to be necked where the can body is held by a co-rotating second holder, which comprises a support part displaceable relative to the can body, having an annular deflection edge, wherein forming is achieved by at least one deforming surface joining the deflection edge at a distance in axial direction and being adapted to be pressed towards the interior in radial direction, a free space being provided radial inside the deforming surface in the interior of the can so that nothing obstructs a deformation of the can shell towards the interior.

14. Method according to claim 12, wherein an annular buckle is formed at each of the two face sides of the can shell in radial outward direction, while the can shell (24) comprises a cross-sectional restriction at the buckles towards the respective face side, and that at the restrictions the can bottom and the upper closure member are attached by laser welding.

15. Method according to claim 1, wherein a base covering is fixed in such a manner that the connection of the can shell to the can bottom is covered by it.

16. Method according to claim 1, wherein an upper closure member together with a valve is attached to the can shell by laser welding.

17. Method according to claim 1, further comprising at least one necking step, wherein a can body to be necked, which extends along an axis, is held in two regions, the can body being firmly held by a first holder in the first region so that it may be rotated about its longitudinal axis by the first holder, while the second region is situated at the can end to be necked where the can body is held by a co-rotating second holder, which comprises a support part displaceable relative to the can body, having an annular deflection edge, and a deformation is achieved by at least one forming surface joining the deflection edge at a distance in axial direction and being adapted to be pressed towards the interior in radial direction, a free space being provided radial inside the deforming surface in the interior of the can so that nothing obstructs a deformation of the can shell towards the interior.

18. Device for the production of a can body with a closed can shell and at least one closure member arranged on the can shell, comprising:

a supply arrangement for supplying a metal strip;

first forming device for forming the metal strip into the shape of a tube closed in peripheral direction;

a welding device for substantially continuously welding the tube;

a severing device separating closed can shells from the tube;

a second forming device for forming the sections to can shells with a cross-sectional restriction at least at one face of the can shells; and

an attaching device for attaching a closure member in the form of a can bottom to said at least one restriction of each can shell by laser welding a circumferential seam, wherein the outer marginal region of the can bottom is adapted to the shape of said restriction.

19. Device according to claim 18, wherein the first forming device forms the metal strip continuously around an axis extending parallel to the metal strip in such a manner that the two lateral edges contact each other, and that the welding device connects these lateral edges (by a longitudinal welding seam, and that the severing device comprises a cutting edge that is optionally moved during the cutting procedure together with the arising tube and is reset after having severed a tube section.

20. Device according to claim 18, wherein the welding device is formed and arranged in such a way that it enables welding of a butt-joint or a jump joint welding seam on a flat pressed tube while the lateral marginal regions to be interconnected are supported on the inner side of the can shell.

21. Can body including a can shell, closed by way of a longitudinal laser welding seam, and a bottom fixed at one face side of the can shell, wherein

the can shell consists of metal strip closed in peripheral direction by the longitudinal laser welding seam;

the can shell has a cross-sectional restriction at least at one face of the can shell; and

a closure member in the form of a can bottom is attached to said at least one restriction of each can shell by a circumferential laser welding seam, wherein the outer marginal region of the can bottom is adapted to the shape of said restriction.

22. Can body comprising a closed can shell and a closure member fixed at one face side of the can shell wherein

the can shell has a cross-sectional restriction at least at one face of the can shell;

the closure member is attached to said at least one restriction of the can shell by a circumferential laser welding seam, wherein the outer marginal region of the closure member is adapted to the shape of said restriction; and

the closure member including a valve seat with a metallic inner portion as well as a plastic portion (which surrounds torically the metallic inner portion at least at the valve seat.

23. Can body comprising a closed can shell and an upper closure member fixed at one face side of the can shell wherein

the upper closure member is including a valve;

the can shell has a cross-sectional restriction at least at one face of the can shell; and

the closure member with the valve is attached to said at least one restriction of the can shell by a circumferential laser welding seam, wherein the outer marginal region of the closure member is adapted to the shape of said restriction.

24. Can body according to claim 21, wherein the face side of the can shell and the face side of the bottom attached at said face of the can shell are on opposite sides of the can body, one inside and one outside of the can.

25. Can body according to claim 21, wherein the can shell has a cross-sectional restriction at both faces, further comprising a upper closure member at the upper face opposite to the bottom, wherein the upper closure member is connected to the restriction at the upper face of the can shell by a circumferential laser welding seam, and the outer marginal region of the upper closure member is adapted to the shape of said upper restriction.

26. Can body according to claim 25, wherein the face side of the can shell and the face side of the upper closure member attached at said face of the can shell are on opposite sides of the can body, one inside and one outside of the can.

27. Method according to claim 1, wherein the longitudinal welding seam is formed as a butt-joint or a jump joint.

28. Method according to claim 1, wherein for attaching the bottom to the can shell, the face side of the bottom and the face side of the can shell at the bottom are on opposite sides of the can body, one inside and one outside of the can.

29. Method according to claim 6, wherein a seam covering tape is put on the film strip and made to engage the region of the welding seam after the welding step.

30. Method according to claim 9, wherein forming the can shell includes increasing the circumference of the can shell and creating a cross-sectional restriction from the enlarged one to a smaller cross-section at one can end.

31. Method according to claim 12, wherein for attaching the upper closure member to the can shell, the face side of the upper closure member and the face side of the can shell at the upper closure member are on opposite sides of the can body, one inside and one outside of the can.

32. Device according to claim 18, wherein said attaching device brings together the bottom and the can shell in such a way, that the face side of the bottom and the face side of the can shell at said bottom are on opposite sides of the can body, one inside and one outside of the can.

33. Device according to claim 18, wherein said second forming device for forming the sections to can shells is forming cross-sectional restrictions at both faces of the can shells and said attaching device is attaching an upper closure member at the can shell by laser welding a circumferential seam, wherein the outer marginal region of the upper closure member is adapted to the shape of the restriction at the upper can shell end, and the face side of the upper closure member and the face side of the can shell at said upper closure member are on opposite sides of the can body, one inside and one outside of the can.

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METHOD AND DEVICE FOR THE PRODUCTION OF A CAN BODY, AND CAN BODY

The invention relates to a process according to the introductory clause of claim 1, to a device according to the introductory clause of claim 21, as well as to a process according to claims 16 and 17, and to a can body according to claims 22 and 23.

Container having metal walls and/or shell and bottom, particularly aerosol cans having a decoration, are formed either of one part or of several parts. In the case of one-piece aerosol cans of aluminum, the cylindrical can body is provided by cold sinking. Subsequently, a valve seat is formed at the open end by means of an upset necking procedure. This process of production is very expensive due to the installation required for the bulk of treatment steps as well as for the requirements regarding water and energy for cleaning and drying. U.S. Patent No. 4,095,544 and EP-0 666 124 A1 describe the production of seamless steel cans. There, a cylindrical can body is manufactured from a steel sheet coated with tin or plastic material by punching, pressing and ironing. It turned out that enormous problems occur with forming restricted neck portions, because the material's structure is changed and hardened by ironing. Very current are also cans of steel sheet where the shell has a longitudinal welding seam. The bottom and the upper closure are fastened to the shell by folded seam connections. With folded seam connections sealing problems may occur which, for example, are reduced by sealing rings. Problems result also in the current extremely thin-walled cans with sealings that are arranged on the end face. From documents EP 200 098 A2 and EP 208 564, two-piece or multipart cans are known where the parts are interconnected by laser welding. The shape of the cans given by the known laser welding seams in the interconnection zones between the can's wall and the bottom or valve seat are not attractive and, moreover, a cost-effective

production of sufficiently high piece numbers per time unit cannot be achieved with the known process. The above-mentioned longitudinal welding seams, particularly the longitudinal welding seams known from U.S. Patent No. 4,341,943 too, have small steps or differences in thickness in peripheral direction which lead to problems at the can body when necking the neck portion, and to an elevated load of the necking tools.

From WO 02/02257 A1, a process for forming a neck portion is known where a deforming surface cooperates with a propping surface in such a manner that the can's wall is deformed between these two surfaces under tensile forces. In doing this, the deforming surface is moved inwards in radial direction, while the can's wall is always in contact to the propping surface that engages the radial inner side. It has turned out that the gap region between the two surfaces, which engage both sides of the can's wall, have to be precisely adapted to the wall thickness which is variable in this region, and that the tensile forces in the can's wall have to be continuously chosen in such a way that necking does not result in a bulb. In the case of a bulb, the forces acting through the two surfaces onto the can's wall would become locally very high which entrains the risk of damaging. It has turned out that keeping the appropriate conditions when necking by cooperating deforming and propping surfaces is very difficult.

Apart from a restricted neck portion, narrowing is also desired at the transition to the bottom surface of current can bodies. Since mostly the bottom has already been inserted when forming the neck portion, narrowing the bottom region is suitably done previously which, however, is difficult with a can shell having no upper or lower closure.

For esthetic reasons and to mark its contents, a decoration is applied at the outside of the shell surface. In order to be able to do without expensively and inflexibly printing the can body, printed films are applied onto the can body. According

to EP 0 525 729, a decorating film is directly wound in peripheral direction onto the can body, and is connected to form a closed film envelope on the can body. Separating a piece of film is very difficult with thin films. To interconnect the film ends by a seal connection, a seal surface is pressed against the can body which is, however, not quite convenient with thin-walled cans due to their small stability. With cans whose outer surfaces are restricted at the lower, and particularly at the upper can end and which deviate from a cylindrical surface, forming a non-wavy seal connection over the whole can height is not possible.

Solutions are known from documents US 4,199 851, DE 197 16 079 and EP 1 153 837 A1 where a shrinkable flat plastic material is wound around a coil mandrel to form a closed envelope, is shifted in axial direction as an all-around label onto a bottle or a can, and is then shrunk-fixed. Shifting the all-around label over a bottle or a can without jamming involves various problems, particularly with thin films. With the thin decorating films mentioned in EP 1 153 837 A1, having a thickness of less than 25μm, preferably between 9μm and 21μm, the risk of deforming or damaging is very high when shifting the closed film envelops from the coil mandrel onto the can body. The printable commercial plastic film Label-Lyte ROSO LR 400 of the Mobil Oil Corporation comprises a thin seal layer on both sides and is available with a thickness of 20μm and of 50μm. When sealing the overlapping zone the sealing layer which engages the coil mandrel is also heated and pressed against the coil mandrel. The film has now different sliding properties in the region of the seal strip. Further problems may occur through friction dependent electrostatic loads and the involved forces which act onto the film. Transferring a cylindrical closed film from a coil mandrel to a can body is problematic even if the diameter of the coil mandrel is a little bit larger than the diameter of the can body. A clear difference in size is not desirable, because in this case the ability of shrinking of the film has to be larger, and there

is the risk that undulations form under fix-shrinking. In addition, for raising the ability of shrinking a film of a greater thickness had to be used which is not desirable. A further problem consists in that thin films can be separated only at large expenses. Due to the difficulty of separating alone, solutions are not desired where film pieces are wound around a coil mandrel or around a can body.

The known approaches for producing cans use expensive installations, and their operation is dependent upon a specialized personnel. Therefore, the cans cannot be produced at the filling factories. Thus, much transport expenses will occur to transport empty cans from the can producer to the filling factories.

It is an object of the present invention to find a solution by which esthetically attractive cans may be produced in a cost-effective manner using a simple installation.

This object is achieved by the characteristics of claim 1 and claim 18 or claim 21. The dependent claims describe preferred or alternative embodiments. The term can body should mean all containers, particularly also collapsible tubes, and container-shaped intermediate products. When solving the task, a process for forming a neck portion at an open can end according to claim 17, a process for fixing a can closure comprising a valve according to claim 16, a can body including a valve seat according to claim 22, and a can closure including a valve according to claim 23 have been found, the subject matters of which are new and inventive even independently from the can production.

When solving the task, one recognized in a first inventive step that the longitudinal seam can be formed particularly efficiently and with an extremely high quality, if it can be produced continuously over a large extension of length. A longitudinal seam can be produced continuously over a large ex-

tension of length, if the longitudinal seam is welded on directly joining can shell surfaces closed in peripheral direction or with a tube production. After welding, the can shells, which join each other, can subsequently be separated from one another, while in some cases separating has to be effected at the seam. The closed shell surfaces are separated from a tube as tube sections.

A tube is preferably produced from a metal strip, for example in accordance with DE 198 34 400. A forming device forms the metal strip continuously in such a way that the two lateral edges contact each other, and a welding device welds these lateral edges together. Forming the strip into a tubular shape is preferably effected by plying the strip in transverse direction about a tube axis parallel to the longitudinal axis of the strip. The cross-sectional shape may be chosen for forming in such a manner that welding can be done efficiently. The term tube shall mean any closed shell surface extending around an axis. In a preferred embodiment, a flat pressed tube is produced, wherein, preferably prior to forming, two incisions in the strip are made perpendicularly to the strip axis of the flat strip. These incisions are arranged in such a manner that, after a forming step for the strip, they extend in the bent regions of the flat pressed endless can shell. In this way, cutting for separating the desired can shell sections can be limited to the flat pressed region between the bent regions.

The metal strip is unwound from a coil and, therefore, may have a very great length. If the coil change is realized in such a way that the leading end of a new coil joins immediately the trailing end of the old coil, one can speak of a continuous tube production. Therein, the longitudinal seam may be substantially formed as an uninterrupted seam of a high quality.

When metal plates are processed, first, sections are severed having the size of a can shell. From these sections one may form closed can shells. In a preferred embodiment, these can shells are pressed flat and have two bent regions. The longitudinal seam is welded at the directly joining sections. Sections of the same cross-sectional shape, which join each other directly, form a tube.

The welding device remains preferably stationary, and the metal sheet formed into a tube-shape is moved past the welding device. For forming the seam, various welding techniques may be used. However, preferably the seam is produced by laser welding. The edges of the metal strip interconnected by welding join in some cases in an overlapping manner, but preferably as a butt-joint or jump joint. With a butt-joint, steps or differences in thickness can even be avoided in the region of the seam so that a substantially constant wall thickness of the tube in peripheral direction is ensured. This is particularly advantageous for forming a restricted neck portion. From the continuously forming tube, sections with the length of the desired can height are severed.

In a second inventive step, it has been recognized that preferably a novel and inventive separating process may be used for a continuous tube for severing tube sections, which are further processed as can shells. The known separating processes are sawing processes. Therein, a severing device, such as a cutting-off wheel or a sawing band, is carried with the tube during the sawing procedure. Having severed a tube section, the severing device is reset. Due to the short tube sections, required in the can production, the known severing devices are insufficient, because they are not able to severe and reset sufficiently quickly. A further disadvantage of the known severing devices consists in that there is the risk of a deformation and, thus, of jamming particularly with thin-walled tubes. Moreover, with the known severing processes sawdust is created which would make necessary additional cleaning

steps and/or would cause some problems in the further can production steps.

If the tube is pressed flat for the novel and inventive severing of tube sections, a cutting process may advantageously be used with thin sheets. In doing this, for example, the flat-pressed tube is guided on a base which may cooperate with a cutting edge. As soon as a desired length of a tube section is advanced, the cutting edge is moved together with the tube, and is moved, while cutting through the inter engaging wall regions of the tube. With cutting, no sawdust is produced, and the cutting procedure is extremely fast so that the cutting edge, after a return motion away from the base surface, can be sufficiently quickly moved back in longitudinal direction of the tube, even with short tube sections, to carry out the next cutting procedure in time. With a cutting edge fixedly placed in the direction of the tube axis, it has to be ensured that the tube is able to bend in a bending region due to fixing at the cutting edge so that the retained advance motion is absorbed as a bending elongation in the bending region. After cutting, bending is compensated by a somewhat higher advance speed of the tube end at the severing device. It will be understood that cutting processes are also possible, in which the tube is not pressed flat.

If a tube has been already provided with a decorative film when severing the tube sections, the decorative film can be cut directly in conjunction with the stability providing portion of the can shell. In this way, one can do without cutting thin film pieces separately. It would be possible to apply the decorative film already prior to forming the tube onto the metal sheet, in which case, however, the film would be affected in the region of the longitudinal seam when welding this longitudinal seam. In some cases, the film is only applied to the welded tube, This is preferably done by supplying a film strip in the direction of the tube axis, the film strip being wrapped in peripheral direction around the tube so that

the two edges of the film either abut to each other or overlap a bit one another. The adherence of the decorative film to the tube is achieved, for example, by a sealing procedure. Applying a film web, to be unwound in longitudinal direction of the tube, to the outside of the tube being formed is substantially simpler than wrapping film pieces around tube sections. But directly joining can shell surfaces, being closed in peripheral direction, can be covered, like a tube, at the outside with a film.

If the starting material, i.e. either metal plates or the strip, is provided with a decorative film and/or with an inner film, the film can be cut directly in conjunction with the stability providing portion of the can shell when cutting the open or closed shell sections. In this way, one can do without cutting thin film pieces separately.

If the decorative film is applied to the metal sheet already prior to forming the longitudinal seam, affecting the decorative film during welding of the longitudinal seam can be prevented by additional treatment steps. For example, the decorative film may be arranged on the flat material in such a manner that one of its marginal region does not reach up to the side face, while its other marginal region protrudes beyond the respective side face. The protruding film portion will not be fixedly sealed to the flat material in a marginal region of the same so that this free film margin may be plied away from the region of the welding seam before the welding seam is formed. After the welding procedure, the free film margin can be put over the welding seam and can be sealed. In this way, the longitudinal seam is completely covered. It has turned out, that for welding the longitudinal seam laser can be used which form only a very narrow seam. In the region of a narrow seam, the decorative film may be removed by a further laser. In this way, one can do without having a film-free marginal region, and the decorative film may be applied to the metal sheet over the entire width.

After severing tube sections, be they with or without a decorative film, these tube sections are opened by a shell forming device in such a way that can shells are provided into which a bottom can be inserted. Opening can ensure a desired cross-sectional shape, and if the entire circumference is somewhat increased, even a desired reduction of wall thickness can be achieved. This reduction of wall thickness may be used for precisely approaching a desired wall thickness. When pushing open, it has been recognized that it is not only the desired cross-sectional shape that can be formed, but that a cross-sectional restriction from an enlarged to a smaller or original cross-section may be created when enlarging the cross-section at the can end, towards which an enlarging tool is moved. Such a small cross-sectional restriction would be particularly adapted for forming advantageous connections between the can shell and a can bottom. The cross-sectional restriction would suitably be formed with a radius of curvature which corresponds to shape that is current in aerosol cans at the transition from the can wall to the can bottom.

With a can shell having a small cross-sectional restriction, as is provided for at one can end in aerosol cans, a can bottom may be put to engage the restricted marginal region, and may be attached in a sealing manner to the can shell by circumferential welding. If the can bottom is put to engage the cross-sectional restriction from the interior and is welded to it, with a can that stands on its support surface, it is merely the cross-sectional restriction of the can wall towards the support surface that is visible. The inserted can bottom cannot be seen. The can, in the region of the can bottom, has the appearance of an aluminum mono-block can.

Because no treatment, which hardens the material, is carried out when producing the can shell, a necking process known in the prior art, such as upset necking or spin-flow-necking, can be effected at the upper end of the can shell. This necking

can be carried out up to forming the valve seat. Preferably, however, necking is effected only to such an extent that a closure member together with the valve seat can tightly be arranged at the upper restricted end. In some cases, the connection is formed as a folded seam connection, but preferably as a welded connection, particularly as a laser welded connection. Inserting the closure member including the valve seat ensures the production of cans having an extremely precise valve seat by a simple production process.

Since for tightly pressing the closure member to the can shell a shoulder-shaped restriction is required at the face of the can shell as well as a correspondingly shaped marginal region of the closure member, an annular buckle radial to the exterior may be formed at at least one face, in some cases at both faces. In this way a restricted cross-section is obtained towards the respective face. At one face, the can bottom, and at the other face an upper closure member may be fixedly welded to the respective restriction. Preferably, it is the bottom which is welded first. Prior to or, in some cases, after fixedly welding the upper closure member, the can shell may be formed, for example by enlarging the can's cross-section at least up to the diameter of the at least one buckle.

Prior to fixedly welding the upper closure member, forming tools, such as rolls, may be inserted into the interior of the can for enlarging the can shell. In some cases, even a fluid under pressure is introduced into the interior of a can for enlarging the can cross-section, and the can shell is pressed into an inner mold, as is known from Patent nos. EP 853 513 B1, EP 853 514 B1 and EP 853 515 B1. Other processes known from the prior art for enlarging and forming a can shell may also be used.

Within the frame of the present invention, a process for fixing a valve to a can body has been found which is novel and inventive even independent from the production process for the

can shell. For fixing a valve to an aerosol can, a valve seat is provided on the can body. A connection bowl including the valve is crimped on the valve seat. If the valve seat is formed by necking and forming the can shell, breathers are formed at the valve seat which may lead to undesirable micro-leakages after crimping the connection bowl. Even with a valve seat, which is formed separated from the can shell on a closure member, breathers may occur. And even if no breathers appear, crimping the connection bowl to the valve seat is an expensive treatment step. In addition, a valve seat of a standard diameter is used for aerosol cans of a differently large diameter which has as a consequence with small cans, that one cannot fall below a minimum can diameter.

In the frame of an inventive step, one recognized that the construction, which comprises a valve seat and a valve as well as a connection bowl, is due to the fact that the valves are set onto the aerosol cans at the filler to enable filling prior to setting the valves. However, it has turned out that many products are filled into a can through the valve. Filling through an annular zone between the valve seat and the connection bowl and subsequent crimping is not necessary with many products. Therefore, fixing the valve may be done prior to filling.

With aerosol cans which are filled through the valve, the upper end region of the can shell may be connected to an upper closure member including the valve. The closure member corresponds substantially to a connection bowl without an encompassing zone for the valve seat. The valve is located at the center of the closure element, and the closure element is preferably merely dome-shaped. With a welding step, the closure member with the valve is fixed to the can shell by laser welding. A circumferential, closed seam ensures then a tight and solid connection at small expenses, if the free end of the can shell is somewhat restricted so that the engaging marginal region of the closure member may be tightly pressed on and may

be secured to the can shell by a laser welding seam. By arranging a sealing material to the inner side of the can shell in the region of the welding seam, one may ensure that a complete inner coating is guaranteed after welding the can body.

There is a multiplicity of advantages of this inventive approach. One can do without forming or fixing a valve seat on the can body, and the expensive crimping step is omitted. Correspondingly, the filler can do without an installation for fixedly crimping connection bowls. However, it is also possible to produce aerosol cans, the diameter of which is smaller than the diameter of a standard valve seat.

A laser welding connection between the can shell and the closure member can be formed in a simple manner, if the can shell has a constant thickness at the upper end. This is the case with can bodies which are either produced by deep-drawing or where the can shell is closed with a butting longitudinal welding seam.

Within the scope of the present invention, a necking process has been found which is novel and inventive even independently from the production process for the can shell. Thus, the process may be used for all can bodies where a restriction may be achieved at an open can end. In this process, the can body to be necked is held in two regions. In the first region, the can body is firmly held by a first holder so that it can be rotated about its longitudinal axis by the first holder. The number of revolutions is about in the range of 800 to 1500 rpm. The second region is at the can end to be necked. There, the can body is held by a second holder that rotates with it. The second holder comprises a bearing portion displaceable in longitudinal direction relative to the can body. The bearing portion comprises an annular deflection edge at that end which is directed towards the can's interior. At least one forming surface is arranged to join the deflection edge in axial direction and to be pressed in radial direction against the in-

side. The forming surface is preferably formed as a tread surface of a rotatably supported roll. A free space is provided radial within the forming surface in the can's interior so that nothing obstructs forming the can wall towards the interior.

The at least one forming surface, preferably the outer surface of a roll, is pressed against the can wall close to the deflector edge, while the can body rotates. In this way, a groove is formed in the can wall. This groove, due to its extension in radial direction, confers some stability to the can body. Any deformation, which deviates from a rotationally symmetrical shape, is prevented by the groove. If now the bearing portion with the deflector edge is moved away from the groove relative to the can body, the groove may be deepened radial inwards by a motion of the forming surface. At the same time, the can body is moved in longitudinal direction of the can to obtain the desired neck shape. The motion of the forming surface in radial inward direction creates tensile forces in the can wall. It has now turned out that the cooperation of the annular deflector edge with the forming surface, and, thus, the omission of a propping surface situated in the can's interior, facilitates necking and prevents the creation of places of punctually high loads. For obtaining the desired forming properties of the can material, the cooperation of the deflector edge with the at least one forming surface is sufficient. The can wall, moved around the deflector edge, assumes a plastic state in the region of the forming surface pushed forward towards the interior. It is advantageous, if at least two, particularly three or more, forming surfaces are arranged at equal angles around the can's periphery. As compared with the known spin-flow-necking devices, a device for carrying out the novel necking method is substantially simpler in construction, because a propping roll or a propping surface may be omitted which is displaceable and located out of the center in the can's interior.

In some cases, a base covering is applied in such a way that it covers the connection of the can shell with the can bottom. Preferably, the base covering consists of a flat plastic material. It will be understood that a flat material having at least one metal layer, particularly of aluminum or steel, or even with a layer of paper board may also be used. The stability conferring layer may, in some cases, be coated with a plastic material. The flat materials used should ensure a robust base covering which will not be damaged in the conveyor devices of filling installations, and which remains as stable as possible even when standing on a wet support. The base covering may be provided with a sealing layer so that it may fixedly sealed at the bottom. Instead of a sealing connection, in some cases a locking connection or a welded connection, particularly with at least three laser welding points, can be formed to fix the base covering. If a magnetizable base covering is used, it may enable a conveyance by a magnet conveyor even with can bodies of non-magnetic material.

The production of a can body having a decorative film is particularly advantageous, if a film is used which is printed optionally on its external side or front side, but preferably on the side facing the can body or back-side. Using a transparent film printed on the back-side, the printed layer of the film is protected so that no affection of the decoration due to friction can occur. A transparent film printed on the back-side may be provided with a sealing layer over the printing layer after printing which ensures a firm sealing connection between the film and the can body as well as in the overlapping area between the film margins even through the printed layer.

In some cases, it is advantageous if the printed layer at the film's back-side has substantially the function of a primary coat, while the remaining decoration is printed onto the front side of the film. When it is the question of a primary coat, this may either be a monotonous primary color or also part of

the decoration, for example the surface of a color or image design. The film web preprinted on the back-side in a first printing office is printed on the front side in a further printing step. This further printing step can optionally be effected at the can producers or in a second printing office to print a specific decoration/information. This means, for example, that in the second printing step, in addition to a primary decoration, an inscriptions are printed which are different each for the respective market. For printing the front side, any printing process known in the art may be used, optionally including some surface treatment after printing.

The drawings explain the approach according to the invention with reference to an embodiment. It is shown in

Fig. 1 a schematic representation of an installation for producing can bodies,

Fig. 2a a cross-section of a metal strip having a plastic film applied and a seam covering tape,

Fig. 2b a cross-section of a tube, which has been formed from the metal strip according to Fig. 2a by bending it about the longitudinal axis,

Fig. 2c a cross-section of a tube according to Fig. 2b after pressing it flat,

Fig. 2d a detail of the flat pressed tube according to Fig. 2c,

Fig. 2e a detail according to Fig. d after fixedly sealing the seam covering tape,

Fig. 3a a cross-section of a flat pressed tube including a plastic film wrapped around the tube,

Fig. 3b a cross-section of a flat pressed tube onto which press rolls press a plastic film wrapped around,

Fig. 3c a plan view of the arrangement according to Fig. 3b,

Fig. 4 a cross-sectional representation of a cylindrical can wall and an enlarging cylinder situated therein in two positions,

Fig. 5 a schematic plan view of a treating station in which cans on a turn-table are connected to a closure member,

Fig. 6a a treating station according to Fig. 5 comprising optical light guide cables for laser welding,

Fig. 6b a lateral view of a treating station according to Fig. 5 comprising optical light guide cables for laser welding,

Fig. 7 a cross-section of a holding device for a treating station according to Fig. 5 and a can body where a bottom is inserted,

Fig. 8 a cross-section of a holding device for a treating station according to Fig. 5 and a can body where the upper closure member is inserted,

Fig. 9a a cross-section of a necking device comprising two situations at the beginning of a necking procedure,

Fig. 9b a cross-section of a necking device comprising two situations during the necking procedure,

Fig. 9c a cross-section of a necking device comprising two situations at the end of the necking procedure,

Fig. 10a a cross-section of a can body of an aerosol can having the bottom inserted and a valve seat put on top,

Fig. 10b a lateral view of a can body having a particular appearance,

Fig. 11a a cross-section of a collapsible tube having a threaded portion inserted,

Fig. 11b a cross-section of a collapsible tube having a threaded portion put on top,

Fig. 12 a cross-section of the upper end region of an aerosol can including a novel valve adapter,

Fig. 13 a cross-section of the upper end region of an aerosol can and two different valve seats, and

Fig. 14 a cross-section of the lower end region of a can body including a base covering,

Fig. 15a a vertical cross-section of a can shell having buckles at both front sides,

Fig. 15b a vertical cross-section of a can body having buckles on the can shell, and fixedly welded closure members,

Fig. 16 a vertical cross-section of an aerosol can including an upper closure member and a valve,

Fig. 17 a part of a vertical cross-section of an aerosol can including an upper closure member and a valve,

Fig. 18a a schematic plan view of a severing device which cuts strips from metal plates,

Fig. 18b a schematic lateral view of a device for applying films on both sides of the strips,

Fig. 18c a schematic plan view of a portion of installation which cuts section from strips and forms them into flat pressed can shells,

Fig. 18d two schematic cross-sections of treating steps for forming sections into the shape of flat pressed can shells

Fig. 19 a schematic lateral view of an installation which covers a strip-like flat material with films on both sides, and which converts the strip material continuously into the shape of a flat pressed can shell,

Fig. 19a a plan view of the flat material after providing incisions,

Fig. 19b a schematic cross-section in the region of forming elements for forming the strip material into the shape of the flat pressed can shell,

Fig. 20 a cross-section of the shape of the flat pressed can shell,

Fig. 21 a schematic cross-sectional view of the step of applying a covering tape,

Fig. 22 a schematic cross-section of a device for laser welding the longitudinal can seam,

Fig. 23 a detail of Fig. 5 at a larger scale,

Fig. 24 a schematic lateral view of an installation part for laser welding the longitudinal seam, for pressing on the covering tape, and for cutting and conditioning closed can shell sections,

Fig. 25 a cross-section of a device for pressing on the covering tape.

Fig. 1 shows an installation for producing can bodies in which a metal strip 1 is supplied from a metal strip supply coil 2 over a deflection device, for example a first deflection roll 3 in the direction of a treatment axis to various treating stations for producing a tube formed by forming and welding. Optionally, the metal strip is preheated by an induction heater 4. Next to the induction heater 4, a first film strip 5 is applied, if necessary, to the metal strip 1 in the direction of the treatment axis from a first film supply coil 6 over a deflection device, for example a second deflection roll 7. The second deflection roll 7 may press the first film strip 5 to the preheated metal strip 1 so that a sealing layer of the first film strip 5 connects at the given temperature the film strip 5 to the metal strip 1. The first film strip 5 should form an inner barrier or inner protective layer 5' on the tube being formed. For forming a closed tube, a welding connection between both lateral edges of the metal strip 1 is necessary. Since the film strip 5 does not stand the temperature generated in the region of the welding seam, the film strip 5 will optionally not extend up to the edges of the metal strip 1 in lateral direction. However, to be able to form, nevertheless, a closed inner barrier, a seam covering tape 8 is applied to the first film strip 5. To this end, the seam covering tape 8 runs from a covering tape supply coil 9 over a deflection device, for example the second deflection roll 7, in the direction of the treatment axis onto the first film strip 5. A sealing layer of the seam covering tape 8 is facing upwards. The seam covering tape 8 should adhere merely temporarily to the first film strip 5.

Fig. 2a shows the metal strip 1 with the film strip 5 connected thereto, and the applied seam covering tape 8 in the cross-sectional region A according to Fig. 1. Arrows 10 indicate the subsequent forming procedure. By bending, according to Fig. 2a, the lateral edges of the metal strip 1 around the longitudinal axis and approaching them to one another, a tube 11 is obtained. To connect the interengaging lateral edges 1a, 1b of the metal strip 1, a welding seam 11a is formed in a welding step including a welding procedure 12. A region 11b left free of the film should be covered after welding by seam covering tape 8.

According to Fig. 1 a forming device 13 is provided for the forming procedure, wherein the metal strip 1 is formed into the tube 11, preferably using rolls. To carry out the welding procedure 12, the lateral edges are pressed together by holding rolls 14 so as to be free of a gap, while a welding device 12a carries out the welding procedure 12. In this way, the welding seam 11a is obtained in the region 11b that is free of film. Preferably, a laser welding device is used, but optionally a conventional welding device is used as is known from the traditional production of three-part can bodies. In the section B, the tube 11 has about the shape according to Fig. 2b. In the production of cans which do not need an inner barrier or an inner protective layer 5', one can omit the supply of a film strip 5 and of a seam covering tape 8.

For the continuous production of the tube 11, as provided, the formed metal strip 1 has to be conveyed continuously. To this end, for example, two conveying caterpillars 15, moving in opposite senses, are provided which press against the tube 11 from opposite sides and entrain the tube 11 by friction. Since the seam covering tape 8 must reach the region 11b free of film, the tube 11 is compressed at least in the region of the seam covering tape 8. This compression is optionally achieved in part by the conveying caterpillars 15. When compressing, to

obtain a desired shape in section C, at least a pair of flat pressing rolls 16a is provided according to Fig. 2c. To obtain a defined shape of the two lateral folding regions 11c, it may optionally be convenient, to associate lateral forming rolls 16b to the two flat pressing rolls 16a. Since the rolls 16a and 16b press in pairs each in opposite directions against the tube 11, the tube 11 can be formed in a desired cross-sectional shape.

Fig. 2d shows how the seam covering tape 8 is pressed against the inner protective layer 5' in the region 11b free of film by compressing the tube 11. When the seam covering tape 8 comprises a sealing layer on the side which engages the inner protective layer 5' and the region 11b free of film, a sealing connection may be formed to the inner protective layer 5' and, optionally, the region 11b free of film under the effect of heat. In this way, a continuous protective barrier is formed in peripheral direction of the tube. The heat necessary for sealing may be supplied through the flat pressing rolls 16a or by an induction heater 4 located in the region of the two flat pressing rolls 16a.

Heating the tube 11 and its metal layer 1' by the induction heater 4 may be used, in addition, for firmly applying an outer film layer 17'. To this end, if desired, a second film strip 17 is applied from a second film supply coil 18 over a deflection device, for example a third deflection roll 19, in the direction of the treatment axis to the outside of the tube 11 subsequently to the induction heater 4. An engaging device, not shown, is used which bends the lateral margins of the second film strip 17 around the tube 11 in such a way that the margins are interconnected in an overlapping area 17a.

Fig. 3a shows the section D comprising two press rolls 20 at both sides of the flat pressed tube region. The press rolls press the film margins in the overlapping area 17a against each other. If now the second film strip 17 comprises a seal-

ing layer at the side facing the tube 11, a sealing connection may be achieved in the overlapping area 17a. In Figs. 3a and 3b, the inner protective layer 5' is not shown, but only the metal layer 1'. To ensure a wrinkle-free engagement of the outer film layer 17' to the metal layer 1', the outer film layer 17' is connected in the overlapping area 17a in such a manner that the circumference of the outer film layer 17' is somewhat smaller than the circumference of the tube 11 and the metal layer 1'. Due to the flat pressed shape of the tube 11, this is easily achieved with the open marginal regions.

In section E, a compression device according to Figs. 3b and 3c comprising at least two first press rolls 21 and optionally two second press rolls 22 are provided. The two first press rolls 21 are situated at both sides of the flat pressed tube region and press the outer film layer 17' tightly against the metal layer 1'. The two second press rolls 21 are situated at both sides of the curved tube region. To ensure a wrinkle-free engagement, the press rolls 21, 22 are preferably provided with slightly elastic coatings 21a and 22a. It will be understood that the outer film layer 17' may also be omitted. The installation for producing can bodies may be used for can bodies either with or without a film layer. It would also be possible to apply a decorative film according to a known process onto a can body produced in accordance with the novel process. However, continuously applying a film strip onto a produced tube is simpler.

To sever sections having the length of the desired can height from the tube 11, a severing device 23 is provided. The severing device 23 should carry out, if possible, a chip free severing step. Since after the severing step the tube sections or can shells 24 have not necessarily to present a specific shape, a cutting procedure is preferably carried out with a cutting edge 25 and a supporting base 26 cooperating with the cutting edge 25. Due to the fact that the tube 11 is substantially pressed flat, the necessary stroke for the cutting mo-

tion represented by arrows 25a is small. The small stroke enables a quick cutting procedure. The cutting edge 25 is optionally moved during cutting with the created tube 11 in the direction of the tube axis, and is reset after having severed a tube section 24 which is illustrated by arrows 27. Since the cutting procedure is very quick, the advance of the tube is small during this short time. Therefore, approaches with a cutting edge 25 being stationarily placed in the direction of the tube axis may also be provided. Then, it only has to be ensured that the tube 11 is able, due to the fixation at the cutting edge 25, to bend in a bending region so that the retained advance is absorbed as a bending elongation in the bending region. After cutting, bending is compensated by a slightly increased advancing speed of the tube end at the severing device 23. If the tube end or the end of the severed can shell 24 is completely rendered flat by the cutting procedure, this is of no importance.

If a film strip 5, 17 and, optionally, a seam covering tape 8 is arranged on the metal strip 1, a tube 11 will form having a metal layer 1' and at least one film layer 5', 17. If a film piece is supplied, according to the prior art, to a can shell, the film piece has to be cut from a film supply coil and has to be placed individually on the can shell 24. Cutting and placing thin films is very difficult. The approach according to the invention with continuously applying the film strip 5 and cutting the film in conjunction with the metal layer 1' leads to substantially simpler film coating. Cutting the metal layer 1' together with the film is simpler, because the total thickness of the metal layer 1' and of at least one film layer 5', 17 is sufficiently large for a simple cutting procedure.

The cut and substantially flat can shells 24 may now be formed to can bodies either immediately subsequently or after an intermediate storage or a transport. Due to the flat state, the volume per can shell 24, needed for storing or transporting, is small.

According to Fig. 1, the flat pressed can shell 24 is pushed open during further treatment by at least one push-open tool 28 of a shell forming device. In the schematically illustrated embodiment, push-open tools 28 having insertion edges 28a are inserted into the can shell 24 from both open faces of the can shell 24. Optionally, the desired cross-sectional shape is obtained directly with pushing open. Preferably, however, an enlarging tool 29 is used in a further step which increases the circumference of the can shell 24 and, in particular, formes at one can end, preferably the lower end, a cross-sectional restriction from an enlarged to a smaller cross-section.

Fig. 4 illustrates the enlarging procedure in two steps. After insertion of an insert front part 29a, adapted to the cross-section of the can shell 24, into the can shell 24 from a first face side 24a, the enlarging tool 29 having an enlarging portion 29b of a larger cross-section is moved through the can shell 24, until it reaches an end position at the second face side 24b of the can shell 24. The enlarging portion 29b is formed in such a manner that the can shell 24 obtains a desired restriction 24c at the second face side 24b, particularly with a narrowing radius usual for aerosol cans.

To obtain a can body 30 prepared to be filled, the can shell 24 has to be provided with a closure member at at least one face side 24a, 24b. For cans, at least one can bottom 31b is tightly connected to the can shell 24. In the case of collapsible tubes, a tube closure part 32, having a thread 32b around an output opening 32a, is fixed. Since more cans are produced than collapsible tubes, and a generic term, as for example container, is confusing, the term can should be understood as far as to comprise also collapsible tubes. According to Figs. 1 and 5, the closure members 31b, 32 are delivered in a delivery step 33 from a supply region 34 to an insertion holder 35. The insertion holder brings the closure members

31b, 32 to the desired connection place of the can shell 24. In the case of a welding connection, a welding device 37 produces a welding seam, while rotating the can shell 24 by means of a rotating holder 36. It will be understood that apart from a welding process, particularly laser welding, mechanical connection processes, such as beading or folded-seam processes, may be used. Optionally, the closure member 31b, 32 is tightly connected to the can shell 24 by gluing.

Fig. 5 shows a treating station in the form of a turn-table 38, wherein the can shells 24 reach the turn-table 38 via a transfer table 39, and the can bodies 24' are conveyed away from the turn-table 38 via a further transfer table 39 to a further conveyance.

Figs. 6a and 6b show the light guides 40 by which a welding beam is directed to the places of treatment of the turn-table 38. The rotating holders 36 are arranged on arms 41 to be pressed against the can shells 24. The insertion holders 35 are preferably coupled to turning drives to be able to produce circumferential welding seams while turning.

Fig. 7, in the form of a representation of a detail, shows the most important elements of a treatment place for fixing a first closure member 31b, 32 to the can shell. When the can bottom 31b is pressed from the interior of the can against to restriction 24c, a laterally not visible connection seam 42 can be produced by the welding device 37. In order to position the can bottom 31b without a large stroke movement, it is optionally pressed against the restriction 24c from the exterior. For firmly pressing, the arms 41 and the rotating holders 36 are connected to the insertion holders 35. The connection is effected via a connecting rod assembly 43 with pressing and releasing devices not shown. The outer marginal region of the can bottom 31b is adapted to the restriction 24c and comprises in the center region a bulging towards the can's interior.

According to Fig. 8, an upper closure member 31a having a valve seat (valve adaptor) is fixed to a can body 24' comprising a can shell 24 and an inserted can bottom 31b. It will be understood that the upper closure member may comprise another type of opening, for example a threaded neck, instead of the valve seat. The device for fixing the upper closure member corresponds substantially to the device according to Fig. 7, wherein the can body 24' is held by a can holder 44 and is rotated, and the rotating holder 36 is adapted to the upper closure member 31a. The first face side 24a, averted from the can bottom, is restricted so that a first neck region 24a' of decreasing cross-section is formed. The circumference of the upper closure member 31a is smaller than the circumference of the cylindrical portion of the can body 24'. Since, in addition, one can do without a folding area for forming a beading or folded-seam connection, the proportion of material of the upper closure member 31a is significantly smaller as compared with known approaches. The connection seam 42 ensures a firm and tight connection between the first neck region 24a' and the upper closure member 31a which, in the outer marginal area, forms a second neck region which is adapted to the first one.

For necking the open face of a can body 24', a known necking process can be carried out, such as upsetting/necking or spin-flow-necking. Preferably, however, as represented in Figs. 9a-d, a process is carried out, which is novel and inventive even independently from the other production steps, wherein a can body 24' to be necked, which extends along a longitudinal axis 24d and has circular cross-sections in the region to be necked, is held in two regions. In the first region, the can body 24' is firmly held by a first holder 45 in such a manner that it may be turned about its longitudinal axis 24d by the first holder 45. For holding it firmly, an annular clamping element 45a is optionally provided which, in particular, may be pneumatically brought into a clamping position and a re-

leasing position. However, a mechanical clamping arrangement, for example comprising three clamping elements 45a which are uniformly distributed around the periphery, may also be provided. The second region is at the can end to be necked or at the first face side 24a. There, the can body 24' is held by second holder which co-rotates with it and which comprises a supporting part 46 displaceable relative to the can body 24' and to the first holder 45 in longitudinal direction. The displaceable supporting part 46 is inserted into the can body 24' in a peg-shaped fashion and comprises at the end directed towards the can's interior an annular deflection edge 46a, the outer diameter of which being adapted to the inner diameter of the first face side 24a.

The desired necking is achieved with at least one deforming surface 47a which joins the deflection edge 46a with a small distance in axial direction and may be pressed inwards in radial direction, while a free space 48 is provided in the can's interior so that nothing obstructs forming the can shell 24 or the can's wall in inward direction. Optionally, a propping peg is provided which projects from the supporting part 46 into the can's interior and whose diameter is adapted to maximum necking so that the necked face, after necking, is supported by this peg. The deforming surface 47a is preferably formed by the outer surface of a forming roll 47. An optimum cooperation of the deflection edge 46a with the deforming surface 47a is important for necking. To this end the radii of curvature R1, R2 of the two curvatures of the deflection edge 46a and the deforming surface 47a are fitted to each other. According to an analogy to a deep-drawing process, where the can wall is drawn around two annular edges, the radius of curvature R1 corresponds to the holding-down radius and R2 to the drawing radius. The gap *s* between the deflection edge 46a and the deforming surface 47a in the direction of the can axis 24d is fitted to the thickness of the can's wall and remains substantially constant during necking. The at least one forming roll 47 is, in axial direction, in a substantially stationary posi-

tion relative to the support part 46. The at least one forming roll 47 is moved together with the support part 46 in axial direction relative the first holder 45.

According to Fig. 9d preferably three forming rolls 47 are equally spaced in peripheral direction of the can body 24' and can be pressed together in radial inward direction up to a minimum can circumference 49. It will be understood that two or more than three forming rolls 47 may also be arranged. If only one forming roll 47 is provided, the occurring forming forces are unilateral which is particularly problematic towards the end of the forming procedure.

Figs. 9a, 9b and 9c show the progress of a necking procedure referring to five situations V0, V1, V2, V3, V4 of an open can end necked more and more. At the beginning V0 of the necking procedure, the forming rolls 47 are spaced in axial direction by a distance *a* from the first face side. The support part 46 extends in the can's interior by an extension of an initial distance *a* minus the gap *s*. As soon as a small necking ring has been formed, as is illustrated about in situation V1, the can shell 24 obtains an increased stability against asymmetrical or undesirable deformations. With proceeding necking, as may be seen in situation V2, the first face side 24a is drawn more and more towards the deflection edge 46a, until it is only held in gap *s*, according to V3, and no longer according to V4. An end region at the first face side 24a is optionally formed in a pressing procedure subsequent to necking. An advantageous shape is illustrated in Fig. 12.

The described process and the described installation enable the efficient production of different can bodies and also of collapsible tubes. Fig. 10a shows an aerosol can 24', where a can bottom 31b is fixed by laser welding to the narrowed second face side 24b of the can shell 24. At the first face side 24a, an upper closure member 31a having a valve seat 50 is fixed by laser welding. The can bottom 31b and the upper clo-

sure member 31a may each be produced independently from the can shell 24. These separately produced parts may have different thicknesses of material and/or different material compositions which are optimized for their respective function. With a separately produced upper closure member 31a, a valve seat 50 of high quality may be ensured.

Fig. 10b shows an embodiment where the can shell 24 is specially formed by a shaping process. Since the material of the can shell 24 of a can body according to the invention is not hardened by an ironing process, known shaping process can be applied without any problem.

Figs. 11a and 11b show can bodies 24' or collapsible tubes having, fixed inside and outside a can shell 24, a tube closure member 32 which comprises a thread 32b for a cap, not shown, around an output opening 32a.

Fig. 12 shows a detail of an upper closure member 31a that is connected to a can shell 24 by a welding seam 42, preferably a laser welding seam. The can shell 24 comprises, for example, an inner coating 5', and is beaded to the exterior at the first face side 24a. The upper closure member 31a comprises a metallic inner portion 51 and a plastic portion 52 which surrounds torically the inner portion 51 at least at the valve seat 50. The metal portion enables a welding seam 42. If the plastic portion 52 engages tightly the inner coating 5', it may be prevented, in some cases, that the contents of the can body contacts the metal layer.

According to Fig. 13, the plastic portion 52 enables insertion of a valve 53 without inserting a sealing 54 which was necessary according to the prior art. The plastic portion 52 has a thickened end rim, where a valve joining part may be surrounded and firmly clamped. Clamping pincers 54' may press tightly the joining rim of the valve 53 to the plastic portion 52. Since the metallic inner portion 51 does no longer need to

be bend by 270°, production of the part 31a is much simplified. The metallic inner portion 51 may be provided with the plastic portion 52 by an injection molding step. This two-component closure member 31a is new and inventive, even independently from the can production process described.

Fig. 14 shows the lower end region of a can body 24', where the can bottom 31b is fixed to the second face side 24b by a welding seam 42. In order to cover the welding seam 42 and the inserted can bottom 31b, a base covering 55 is inserted. The base covering is preferably of plastic material and is fixedly sealed, for example, to the can bottom 31b. Optionally, the second face side 24b is formed or arranged on the can bottom 31b in such a manner that the base covering 55 can be fixed by press fitting. In the embodiment shown, the outer marginal area of the can bottom 31b is beaded to facilitate piling a can bottom staple. The rim of the can bottom 31b could also be beaded downwards to prevent, in the case of an inner coating, that the metallic marginal area 56 of the can bottom 31b contacts the contents of the can.

Fig. 15a shows a can shell 24 having annular buckles 60 which extend to the exterior in radial direction at both face sides 24a and 24b. At the buckles, a cross-sectional restriction is created towards the respective face side 24a, 24b. For forming the buckles 60, two forming rolls 61a and 61b, which fit together, are arranged at the outside and the inner side of the can shell 24. While the can shell 24 is turned passing the forming rolls 61a and 61b, the inner forming roll 61a may be pressed outwards and towards the outer forming roll 61b, until the desired buckle 60 has been formed. By a buckle 60, a shoulder 60a is established at at least one face side 24a, 24b of the can shell 24 without a necking step. Enlargements, in comparison to restrictions, can be produced with a good quality and substantially without problems. Thus, with a small expenditure, a shoulder 60a of a good quality is obtained.

According to Fig. 15b, closure members, for example a can bottom 31b and an upper closure member 31a, are pressed against the shoulders 60a at the buckles 60. A firm and tight connection is formed by a connecting seam 42 in the form of a laser welding seam. Preferably, the can bottom 31b is welded first. Prior to or, optionally, after welding the upper closure member 31a, the can shell may be formed, for example by enlarging the can's cross-section at least to the diameter of the at least one buckle 60. Prior to welding the upper closure member 31a, forming tools, such as rolls, may be inserted into the can's interior for enlarging the can shell 24. Optionally, a fluid under pressure is introduced into the interior of a can for enlarging the can's cross-section, and the can shell 24 is pressed into an inner mold.

Fig. 16 shows an aerosol can 24' produced using a cylindrical can shell 24 with buckles 60. A can bottom 31b has been arranged at a lower shoulder 60a. The outer marginal region of the can bottom 31b is adapted to the shoulder 60a so that the outer rim of the can bottom 31b engages tightly the shoulder 60a when being compressed, thus enabling the formation of a precise and tight laser welding seam as a connecting seam 42. The can shell 24 is enlarged from a first cylindrical shape to a second shape before putting the upper closure member 31a on top. In this way, for example, some desired surface structures may be obtained. For enlarging the can shell 24, optionally forming tools, such as rolls, are inserted into the interior of the can. Preferably, however, a fluid under pressure is introduced into the interior of a can, and the can shell 24 is pressed into an inner mold which is known, for example, from Patent Nos. EP 853 513 B1, EP 853 514 B1 and EP 853 515 B1. The buckle 60 at the upper face side 24a is preferably left in its original shape so that a dome-shaped upper closure member 31a may be pressed against the shoulder 60a, and may be welded on by a connection seam 42.

The upper closure member 31a comprises a valve 62 from which a hose 63 extends to the can bottom 31b, and which can be actuated by a small output tube 62a. An output part 65 slipped onto the small output tube 62a is held in a cap 66. To actuate the valve 62, an actuation area 66a of the cap 66 is pressed onto the output part 65. In this way, the small output tube 62a is pressed downwards and, thus, the valve is opened. The cap 66 is held by a catch portion 66b in a corresponding catch shape of the can shell 24. The catch shape of the can shell 24 is optionally formed by the buckle 60 or by a restricted region between the buckle 60 and the enlarged region of the can shell 24. Optionally, the catch shape may also be formed by the outer rim of the upper closure member 31a or by the connecting seam 42.

The cap 66 covers the upper closure member 31a and, together with the can shell 24 which preferably comprises a decorative film, ensures an attractive appearance which corresponds to that of a one-piece aluminum can. Embodiments are also possible in which the can shell 24 and the can bottom are integrally formed, or in which the connecting seam 42 between the can shell 24 and the can bottom 31b is covered by a base covering. Even if the connecting seam 42 is visible at the can bottom, as a thin laser welding seam it is hardly perceivable. To prevent oxidation of the connecting seam 42, it is optionally sealed by a coating.

To ensure a continuous inner coating also in the can's interior, the can shell 24, the can bottom 31b and the upper closure member are provided inside with a protective layer in the form of a film or of a coating. Optionally sealing material 67 is arranged in an annular shape at the connecting seams 42 so as to ensure also a continuous sealing layer after making the connecting seams 42. In order that coatings do not interfere with the laser welding, the interengaging portions in the region of the laser seam may be treated by a laser for removing

the coating prior to laser welding. The inner coating is thereby not affected.

Fig. 17 shows the upper portion of an aerosol can 24', wherein the can shell 24, at a necked face side 24a, is connected to a dome-shaped upper closure member 31a by the connecting seam 42. The can shell 24 is optionally enlarged from a first cylindrical shape to a second shape before putting the upper closure member 31a on top. In this way, for example, some desired surface structures may be obtained. The closure member 31a comprises a valve 62 from which a hose 63 extends to the can bottom 31b, and which can be actuated by a small output tube 62a. A spraying head 64, slipped over the small output tube 62a, comprises a discharge channel 64a and a cap 64b. The cap 64b extends radial outwards and axially towards the upper closure member 31a preferably so far that the connecting seam 42 is substantially covered so that the upper closure member 31a is not visible. Of the aerosol can 24' appear only the can shell, that comprises a decorative layer, and the spraying head 64.

Independently from the precise form of the welded parts, welding the upper closure member 31a, including the valve 62, is very advantageous. By welding the upper closure member 31a, micro-leakages are excluded. Filling the aerosol can 24' is effected prior to putting on the spraying head 64 through the discharge tube 62a.

Fig. 18a shows a severing device 101 in the form of a rotating shaft, supported on both sides, which has severing elements 102. The severing elements 102 may be positioned in spaces from one another which are assigned to the desired can circumference. If plates of flat material of a metal are conveyed through the severing device 101, strips 103 are formed having a width in the range of the can's circumference and a length of at least one can shell height.

Fig. 18b shows a device for applying films on both sides of the strips 103. The strips 103 are moved along a treatment axis substantially immediately joining each other. Above the strips 103, a coil 104 of the decorative film 106 is located. The strips 103 are heated by a heating device 107 up to a temperature that is necessary for sealing the films 105, 106. Two pressing rolls 108 and a respective sealing layer on the films 105 and 106 ensure a firm connection of the films 105 and 106 to the strips 103. In order to enable further treatment separately of the coated strips, a film cutting device 109 is provided which separates the films 105 and 106 between the strips 103 either mechanically or, optionally, by heat.

Fig. 18c shows a part of the installation which cuts the strips 103 into sections 110 by means of a severing device 101, and which forms them in a first forming device 111a into flat pressed can shells 112.

In the embodiment according to Fig. 20, the flat pressed can shell 112 has a recess 112a in the region of the center line, two flat center regions 112b at both sides of it, an adjacent curved region 112c, and two flat marginal regions 112d which can be pressed onto the flat center regions 112b. At the compressed sides 112e, the can shell is closed by means of laser welding.

According to Fig. 21, a covering tape 113 is arranged in the region of the recess 112a of the flat pressed can shell 112. The covering tape 113 is applied by a supply device 114 onto the inner film 105, preferably immediately after or together with supplying the inner film 105.

Fig. 19 shows an embodiment in which the flat pressed can shells 112 are continuously formed as a strip material, and are subsequently welded so that severing of individual can shells 112 is carried out only at the end. From a coil of flat material 115, strip-like flat material 116 is fed to an inci-

sion device 118 by a supply device 117. The incision device 118 forms two incisions 118e perpendicular to the strip's axis on the strip-like flat material. When forming into the flat pressed shell shape, these incisions 118e reach the two curved regions 112c so that, when severing can shell section, severing the flat material is only necessary in the flat region between the radii of curvature. If severing had also to be done in the regions of curvature, plies would develop during severing which could not be completely flattened.

In the subsequent device, films are applied to both sides of the flat material 116. The strip-like flat material 116 is moved along a treatment axis. Above the flat material 116, a coil 104 of an inner film 105 is located, and below the flat material 116 is a coil of the decorative film 106. The flat material 116 is heated by a heating device 107 up to a temperature that is necessary for sealing the films 105, 106. Two pressing rolls 108 and a respective sealing layer on the films 105 and 106 ensure a firm connection of the films 105 and 106 to the flat material 116.

By a second forming device 11b, the flat material 116, coated on both sides, is formed continuously and transversely to the strip axis into a flat pressed, closed shape whose cross-section corresponds to the embodiment according to Fig. 20. The second forming device 111b comprises, for example, pairs of rolls one after the other which bend the lateral marginal regions of the flat material 116 more and more towards the center. Fig. 19b shows an example of a pair of rolls 119. Prior to bending the lateral marginal regions, the recess 112a is formed in the middle of the flat material 116 by means of a cooperating pair of rolls.

According to Fig. 18d, flat material in the form of sections receives a U-shape and a recess 112a by a first forming device using a forming mold 120 and a complementary first forming tool 121. By means of two laterally acting further forming

tools 122, the lateral marginal regions are completely bent. To press the center region flat, one presses onto the shell section another time with a first forming tool, not shown, having no recess projection and a smaller width.

Laser welding the can's longitudinal seam is effected on the flat pressed can shell strip the same way as on the individual can shells. The individual can shells are preferably fed to a welding device, while immediately joining each other, so that the welding device is able to form the welding seam substantially continuously in a similar way as with a can strip.

Figs. 22 and 23 show a first welding device 123 for laser welding the can's longitudinal seam 124 at the compressed sides 112e of a flat pressed can shell 112. The lateral marginal regions 125 to be interconnected of the flat material are supported each at both sides of the recess 112a on a flat center region of the inner rim of the can shell, which acts as a partial guiding surface 112b. In the embodiment illustrated, the two partial guiding surfaces 112b are formed on the inner side of the can shell.

The can shell 112 has a closed, flat pressed shape, the inter engaging partial surfaces being interconnected by curved regions 112c when welding. One marginal region 125 is pressed against the other marginal region 125 by one of the two lateral pressing rolls 126 by means of a pressing device 127 so that compressing the sides 112a is ensured. In order to be able to hold the two marginal regions 125, pressed in common against a stop, on partial guiding surfaces 112b, holding rolls 128 are arranged in such a manner that they hold the two marginal regions 125 at the sides 112e on the partial guiding surfaces 112b. One of the two holding rolls 128 is pressed by a pressing device 127 against one of the marginal regions 125. The flat pressed can shell 112 is supported by a supporting roll 132 in the region of the holding rolls 128. The other holding roll 128 is held by an adjusting device at an adjust-

able distance to the other marginal region 125. Welding is achieved by a laser beam 130 from a laser source 131.

To prevent an affection of the decorative film 106 when welding the longitudinal seam 124, the decorative film 106 may be arranged on the flat material 116, 103 in such a manner that it does not reach up to the side 112e with one of its marginal regions 125, but projects at the other marginal region 125 beyond the side 112e. The projecting film area 106a is not sealed to the flat material 116, 103 in a marginal region thereof so that this free film margin 106a may be bend from the region of the longitudinal seam 124 prior to forming this longitudinal seam 124. After the welding procedure, the free film margin 106a may be put over the longitudinal seam 124 and may, according to Fig. 25, be sealed. In this way, the longitudinal seam 124 is completely covered.

Any inner film 105 that is damaged in the region of the welding seam 124 is covered by the covering tape 113 so that complete corrosion protection is ensured. A small free space 129 between the sides 112e and the covering tape 113 ensures that it is not affected by welding. After the welding procedure, the recess 112a with the covering tape 113 may be pressed against the welding seam 124 and may be fixed there in such a way that it is firmly sealed at both sides to the intact inner film 105. Since the covering tape does not comprise a sealing layer at the side facing the inner film 105 at the recess 112a, it may be transferred at the longitudinal seam 124 to the inner film 105.

Fig. 24, apart from the holding roll 128 and the supporting roll 132, shows guiding devices 133. Firmly sealing the projecting film area 106a and the covering tape 113, illustrated in Fig. 25, is achieved by two press rolls 134. The heat necessary for sealing stems, in some cases, from the longitudinal seam 124, or is supplied from outside. In an installation with a strip of a can shell, the can shell sections are severed in

a severing device 135, preferably comprising rotating cutting edges. The closed, flat pressed can shells 112' are fed, for example, at top into a conditioning device 136, where they are maintained warm for such a length of time, as is necessary for a lasting connection between the metallic flat material and the decorative film 106 or the inner film 105. The closed, flat pressed can shells 112' discharged at the bottom may be used for producing can bodies either directly, after some storage or after transport.

It will be understood that the features described in the context of different embodiments may be combined, and that the described novel and inventive approaches may be claimed even independently from the present claims. Even if a can shell has not been produced as a tubular section, the described novel necking process and the novel upper closure member comprising a metallic inner portion 51 and a plastic portion 52 to which a valve is clamped is new and inventive. Likewise, welding a closure member 31a having a valve 62 as well as the aerosol can thus produced is new and inventive independently from the process by which the can shell 24 is manufactured.

Claims

1. A method for the production of a can body (24'), by which method a closed can shell (24) having a welding seam (11a), that extends over the entire height of the can shell (24), is provided, and a closure member (31b, 32, 31a) is arranged on the can shell (24), **characterized in that** a tube (11) closed in peripheral direction is formed by a forming step and a welding step, starting from a metal strip (1), said tube optionally consisting of sections (112) which join immediately each other, that a welding seam (11a, 124) is welded substantially continuously in longitudinal direction of the tube in the welding step, and that tube sections of the obtained tube (11), which have the length of a desired can height, are further treated as can shells (24).

2. Method according to claim 1, **characterized in that,** at least one of the following characteristics is provided
a) the welding seam (11a, 124) is formed on a flat pressed tube (11),
b) the arising tube (11) is pressed flat, and tube sections are severed from the flat pressed tube (11),
c) the welding seam (11a, 124) is formed by laser welding, and
d) the welding seam (11a, 124) is formed as a butt-joint or a jump joint.

3. Method according to claim 1 or 2, **characterized in that,** for forming the tube (11), the metal strip (1) is moved in its longitudinal direction through a forming device (13) and is passed next to a welding device (37), the forming device (13) forming the metal strip (1) continuously in such a way that the two lateral edges (1a, 1b) contact each other, and the welding device (37) interconnects these lateral edges (1a, 1b) by a welding seam (11a).

4. Method according to claim 1 or 2, **characterized in that,** for forming a tube (11) which consists of the directly joining sections (112), the metal strip (1) is cut into sections (110), the sections (110), prior to laser welding, are formed into a closed flat pressed shape by means of a forming mold (120) and forming tools (121, 122), the flat pressed sections (112) joining directly each other are put into series , and the welding seam is formed over the joining, flat pressed sections (112).

5. Method according to any of claims 1 to 4, **characterized in that,** a decorative film (17') is applied to the outer side of the metal strip (1) after, or optionally prior to, forming and welding, preferably by feeding a film strip (17).

6. Method according to any of claims 1 to 5, **characterized in that,** a first film strip (5) is put on the flat metal strip (1) in longitudinal direction of the metal strip (1), and is fixed my means of a sealing connection to form an inner protective layer (5'), a seam covering tape (8) is optionally put on the film strip (5) and made to engage the region of the welding seam (11a) after the welding step.

7. Method according to any of claims 1 to 6, **characterized in that,** for severing tube sections, a cutting procedure is carried out with a cutting edge (25), the cutting edge (25), during the cutting procedure, being optionally moved together with the arising tube (11) and being reset after having severed a tube section, but being preferably stationary placed, while the tube (11) during fixation by the cutting edge (25) is enabled to bend in a bending region to absorb the retained advance as a bending elongation in the bending region.

8. Method according to claim 7, **characterized in that,** on the flat metal strip (1) incisions (118e) are formed which after forming and pressing flat are arranged in curved regions (112c) between flat regions (112b, 112d), the cutting procedure being carried out in the flat regions (112b, 112d) between the incisions (118e).

9. Method according to any of claims 1 to 8, **characterized in that,** can shells (24) are shaped by a shell forming device (28, 29) in such a way that a circular cylindrical cross-section is obtained, an enlarging step being optionally carried out which increases the circumference of the can shell (24) and, in particular, creating a cross-sectional restriction from the enlarged one to a smaller cross-section at one can end (24b), preferably at the lower one, the cross-sectional restriction (24c) being optionally formed with a radius of curvature which corresponds to a current shape of aerosol cans at the transition from the can's wall to the can bottom (31b).

10. Method according to any of claims 1 to 8, **characterized in that,** at at least one face side of a circular cylindrical can shell (24) an annular buckle (60) is formed radially outwards, the can shell (24) comprising a cross-sectional restriction towards the face side at the buckle (60).

11. Method according to any of claims 1 to 10, **characterized in that,** a can bottom (31b) is connected at a lower face side (24b) of the can shell (24) tightly to the can shell (24) by circumferential welding, the can bottom (31b) being made to engage the restriction (24c) of the can shell (24), and a welding connection being formed in this position.

12. Method according to any of claims 1 to 11, **characterized in that,** at least one necking step is carried out at an upper face side (24a) of the can shell (24), a valve seat being optionally formed after necking, but that preferably a closure member (31a) including the valve seat is tightly connected to the can shell (24) at the upper, necked end, optionally by means of a folded seam connection, but preferably by a welding connection, particularly by a laser welding connection.

13. Method according to claim 12, **characterized in that,** in the at least one necking step, the can body (24') to be necked is held in two regions, the can body (24'), in a first region, being held by a first holder (45) so that it may be rotated about its longitudinal axis (24d) by the first holder (45), while the second region is situated at the can end to be necked where the can body (24') is held by a co-rotating second holder, which comprises a support part (46) displaceable relative to the can body, having an annular deflection edge (46a), wherein forming is achieved by at least one deforming surface (47a) joining the deflection edge (46a) at a distance (*a*) in axial direction and being adapted to be pressed towards the interior in radial direction, a free space (48) being provided radial inside the deforming surface (47a) in the interior of the can so that nothing obstructs a deformation of the can shell (24) towards the interior.

14. Method according to claim 10, **characterized in that,** an annular buckle (60) is formed at each of the two face sides (24a, 24b) of the can shell (24) in radial outward direction, while the can shell (24) comprises a cross-sectional restriction at the buckles (60) towards the respective face side (24a, 24b), and that at the restrictions the can bottom (31b) is welded to one face side (24b) and

an upper closure member (31a) is welded to the other face side (24a).

15. Method according to any of claims 1 to 14, **characterized in that,** a base covering (55) is fixed in such a manner that the connection of the can shell (24) to the can bottom (31b) is covered by it.

16. A method for fixing a valve to a can shell (24) which, preferably, is produced by a method according to any of claims 1 to 15, **characterized by** a welding step in which an upper closure member (31a) together with a valve (62) is fastened to the can shell (24) by laser welding.

17. A method for necking an open face side (24a) of a can body (24'), **characterized by** at least one necking step, wherein a can body (24') to be necked, which extends along an axis (24d), is held in two regions, the can body (24') being firmly held by a first holder (45) in the first region so that it may be rotated about its longitudinal axis (24d) by the first holder (45), while the second region is situated at the can end to be necked where the can body (24') is held by a co-rotating second holder, which comprises a support part (46) displaceable relative to the can body, having an annular deflection edge (46a), and a deformation is achieved by at least one forming surface (47a) joining the deflection edge (46a) at a distance (*a*) in axial direction and being adapted to be pressed towards the interior in radial direction, a free space (48) being provided radial inside the deforming surface (47a) in the interior of the can so that nothing obstructs a deformation of the can shell (24) towards the interior.

18. Device for the production of a can body (24'), comprising means for tightly connecting a can shell closed by a welding seam (11a, 124) to a closure member (31b, 32, 31a) to

be fixed to the can shell (24) at the face side, **characterized in that** the device comprises a supply arrangement for supplying a metal strip (19, at least one forming device (13) for forming the metal strip (1) into the shape of a closed tube (11), optionally consisting of sections immediately joining each other (112), a welding device (37 for substantially continuously welding the shaped tube (11), and a severing device (25), which enables separating closed can shells (24) from the tube (11).

19. Device according to claim 18, **characterized in that** the forming device (13) forms the metal strip (1) continuously around an axis extending parallel to the metal strip (1) in such a manner that the two lateral edges (1a, 1b) contact each other, and that the welding device (37) connects these lateral edges (1a, 1b) by a welding seam (11a), and that the severing device (25) comprises preferably a cutting edge (25) that is optionally moved during the cutting procedure together with the arising tube (11) and is reset after having severed a tube section, or is, in particular, stationary, while the tube is enabled to bend to absorb the retained advance as a bending elongation in the bending region.

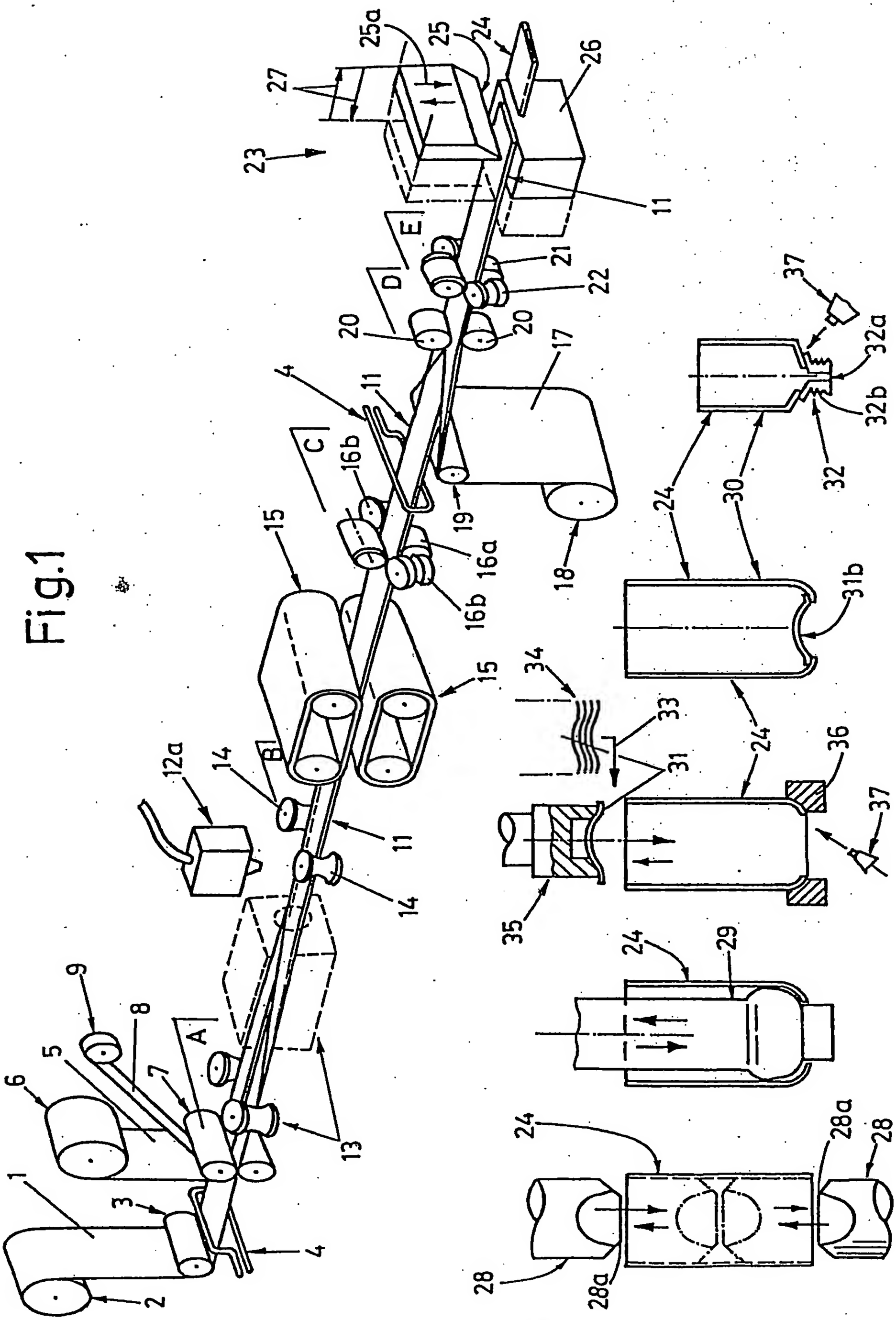
20. Device according to claim 18, **characterized in that** the welding device (37) is formed and arranged in such a way that it enables welding of the welding seam (11a, 124) on a flat pressed tube (11), optionally consisting of flat pressed sections immediately joining each other (112).

21. A can body (24') comprising a can shell (24) closed by means of a welding seam (11a) to which a closure member (31b, 32, 31a) is fixed at the face side, **characterized in that** the can body (24') is produced by a method according to any of claims 1 to 16.

22. A can body (24') comprising a closed can shell (24) to which a closure member (31a) including a valve seat (50) is fixed at the face side, **characterized in that** the closure member (31a) is connected to the can shell (24) by a welding seam (42) and comprises a metallic inner portion (51) as well as a plastic portion (52) which surrounds torically the metallic inner portion (51) at least at the valve seat (50).

23. A can body (24') comprising a closed can shell (24) to which an upper closure member (31a) including a valve is fixed at the face side, **characterized in that** the upper closure member (31a) is connected to the can shell (24) by a welding seam (42).

Fig.1


25a
25
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27
23
11
E
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D
22
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17
4
11
C
16b
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15
16b
16a
15
B
12a
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A
9
8
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28a
28
28
28a

Fig.2a

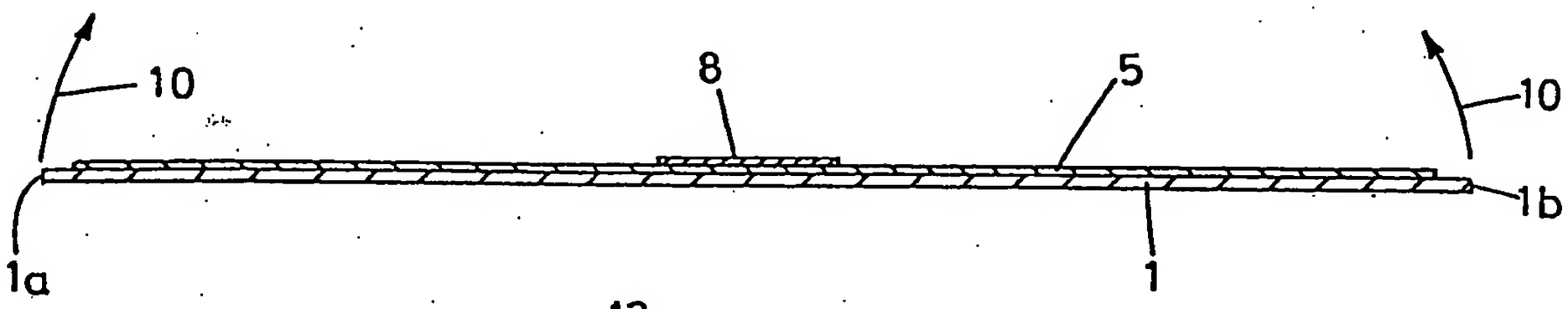


Fig.2b

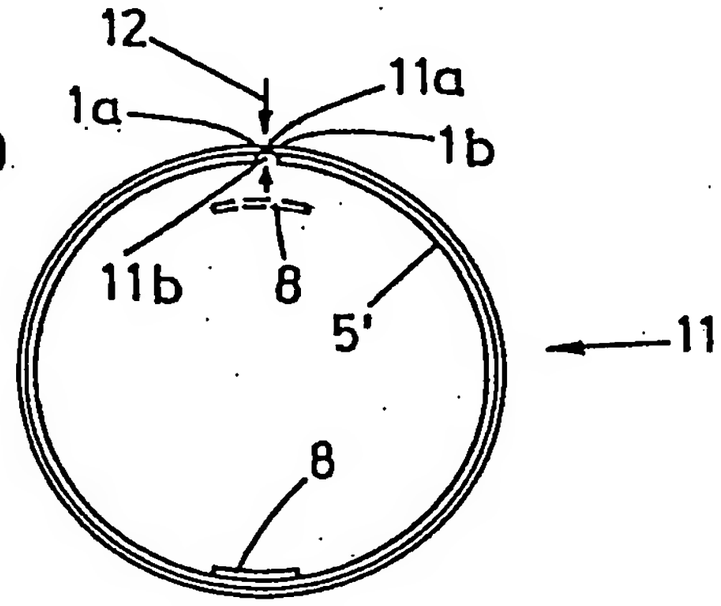


Fig.2c

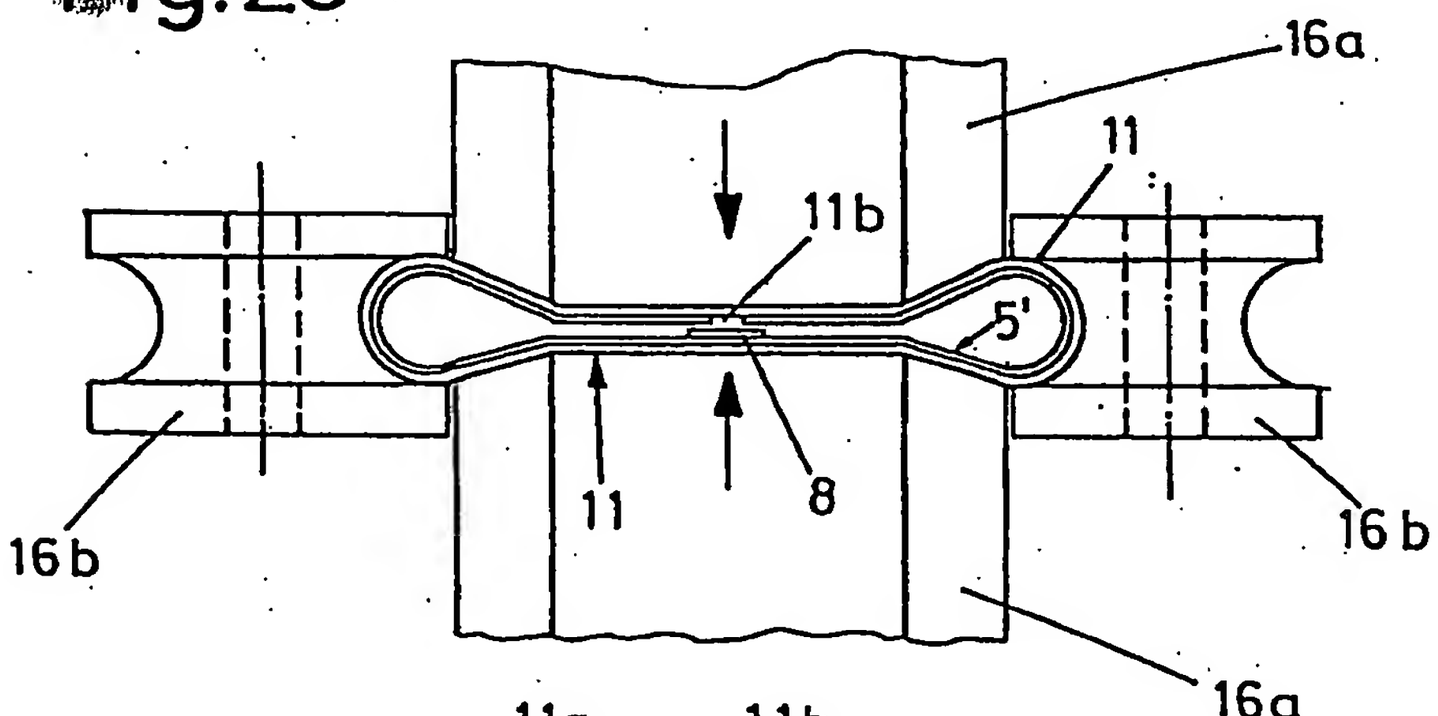


Fig.2d

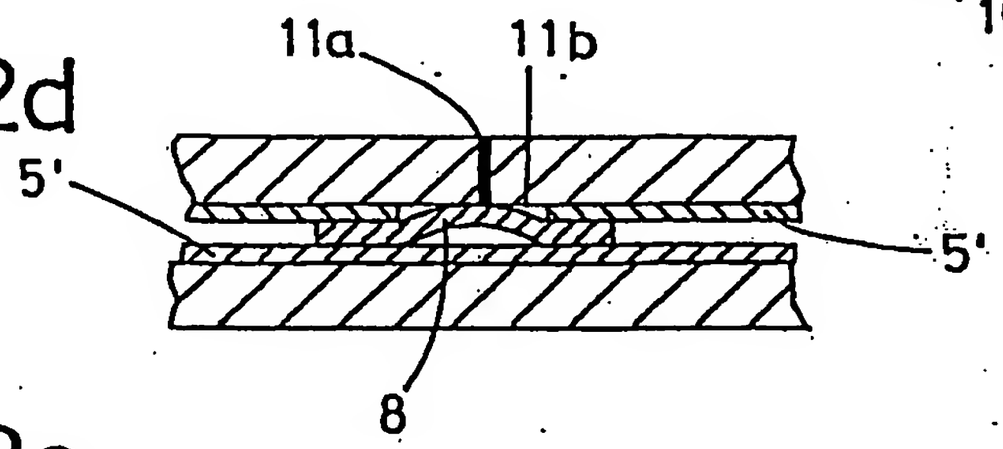


Fig.2e

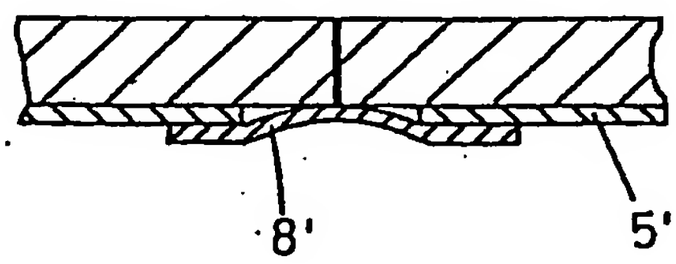


Fig.3a

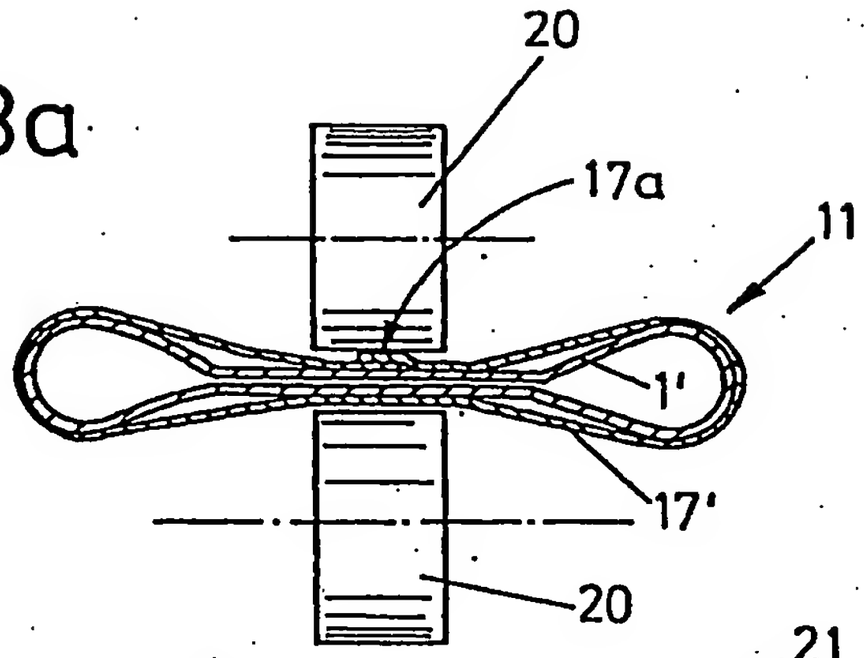


Fig.3b

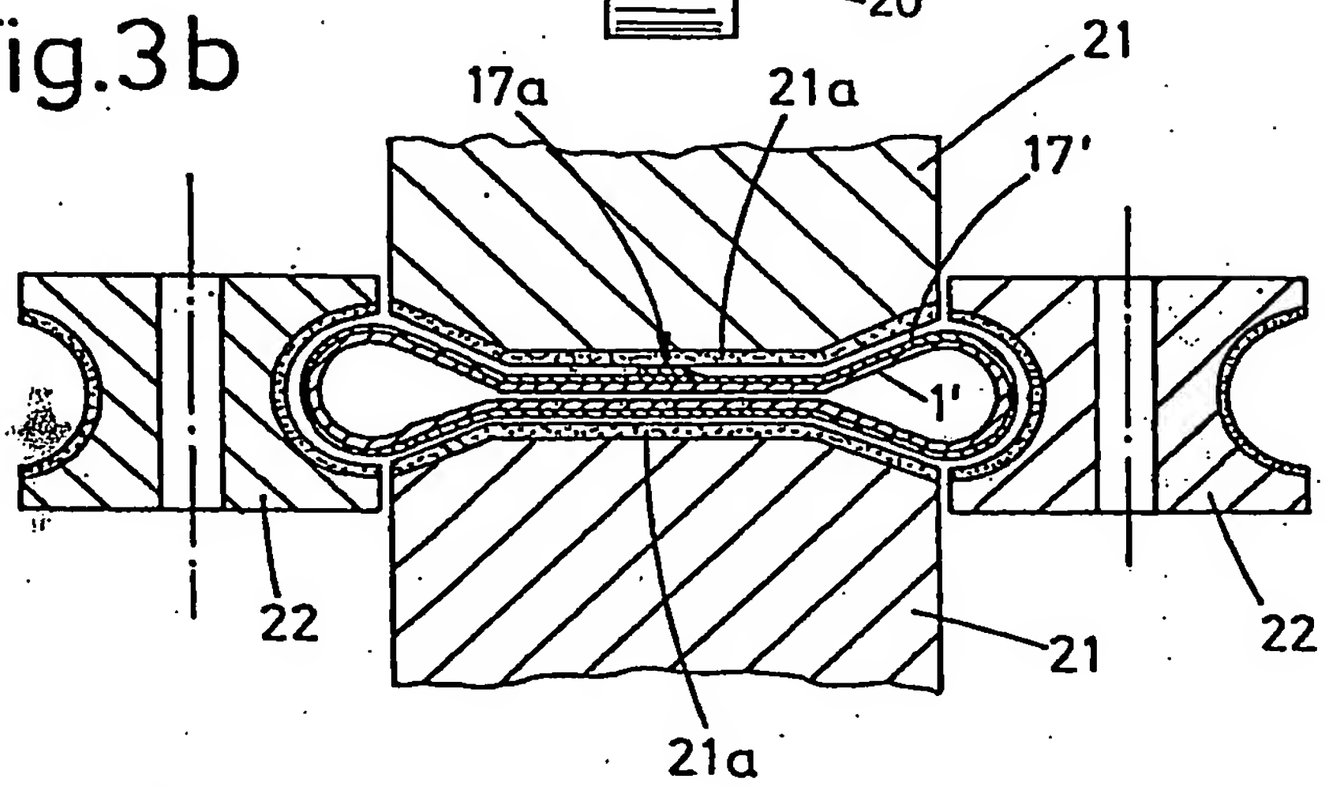
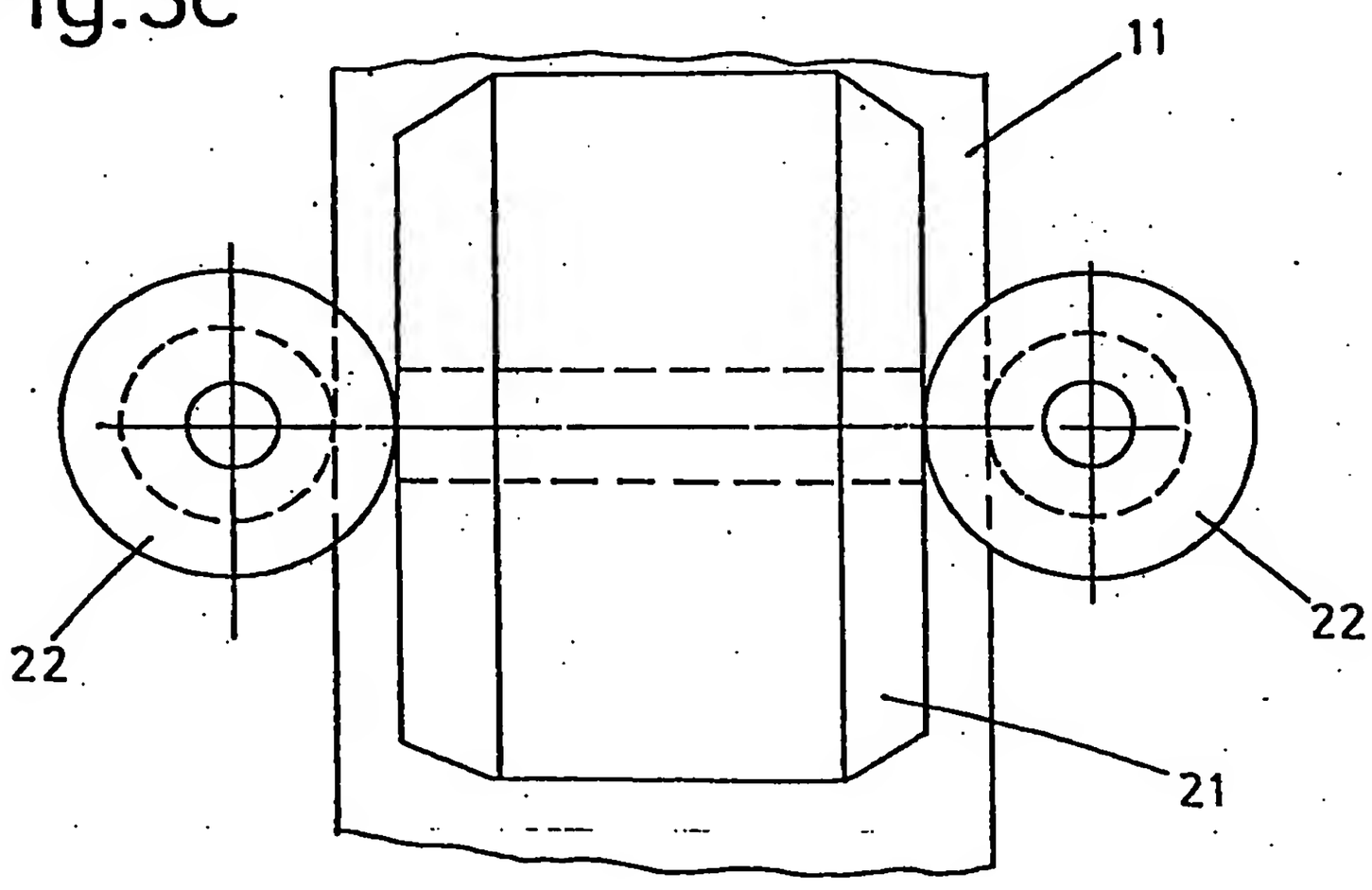


Fig.3c



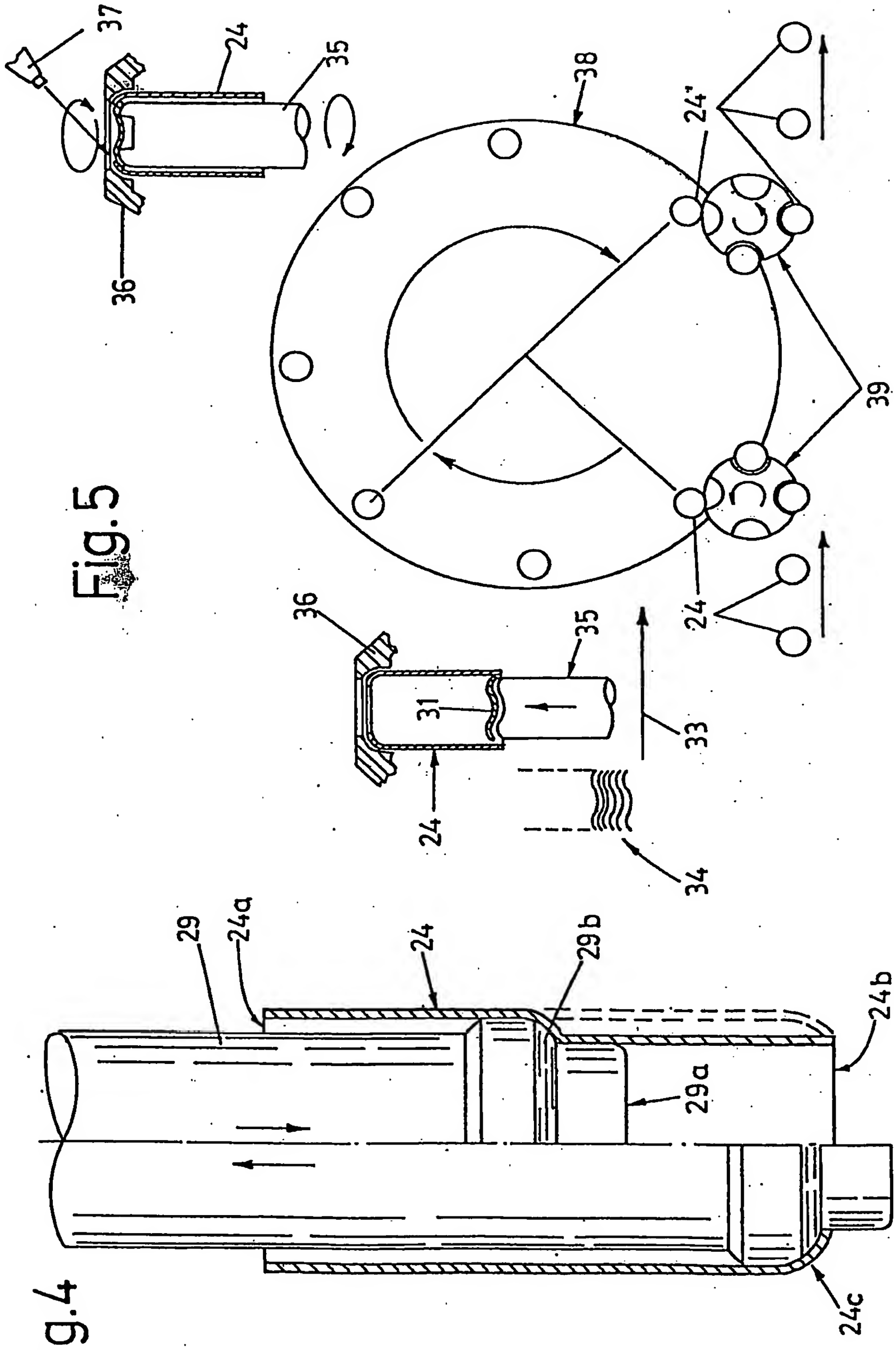


Fig.5

Fig.4

Fig.6a

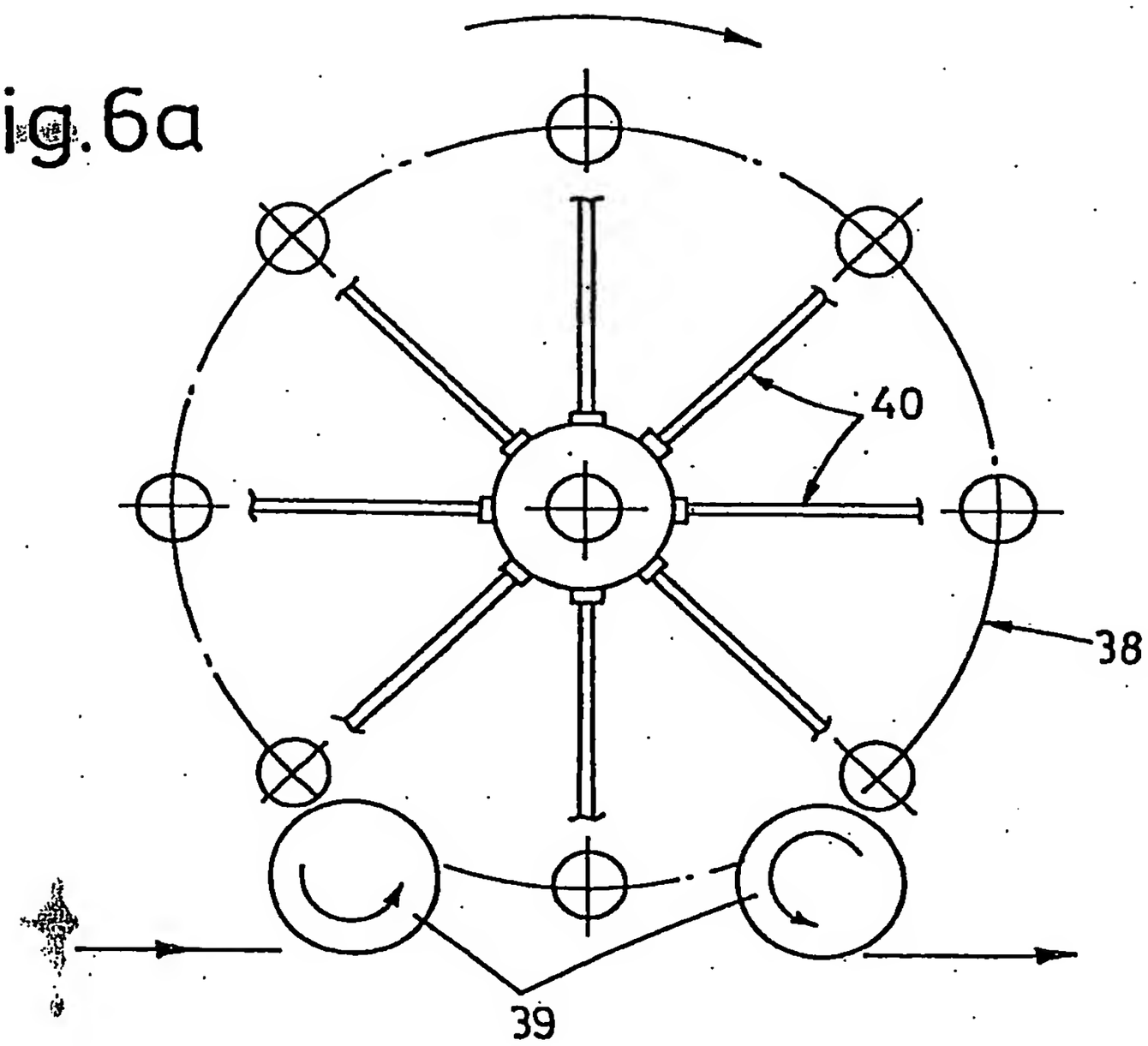
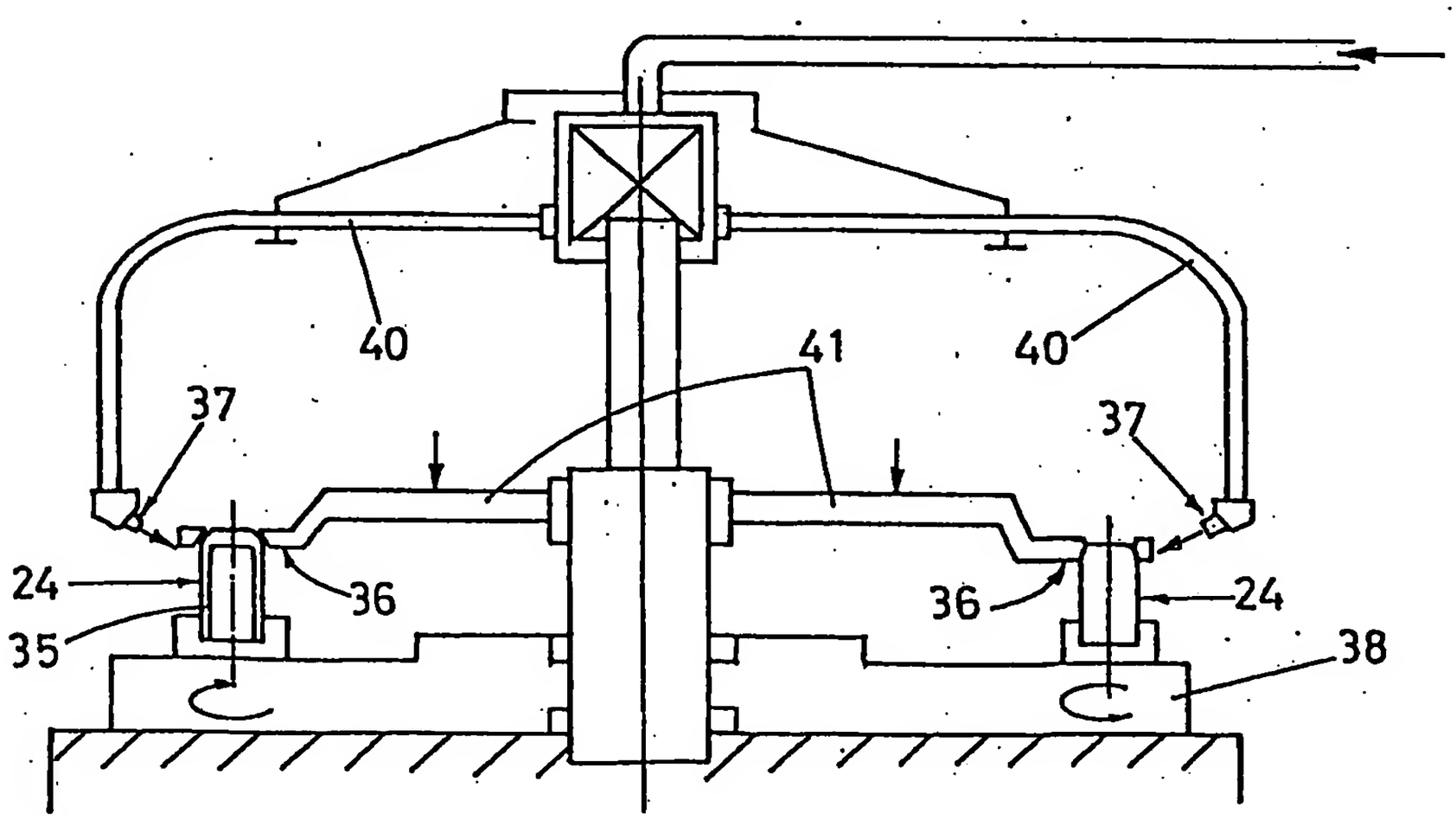


Fig.6b



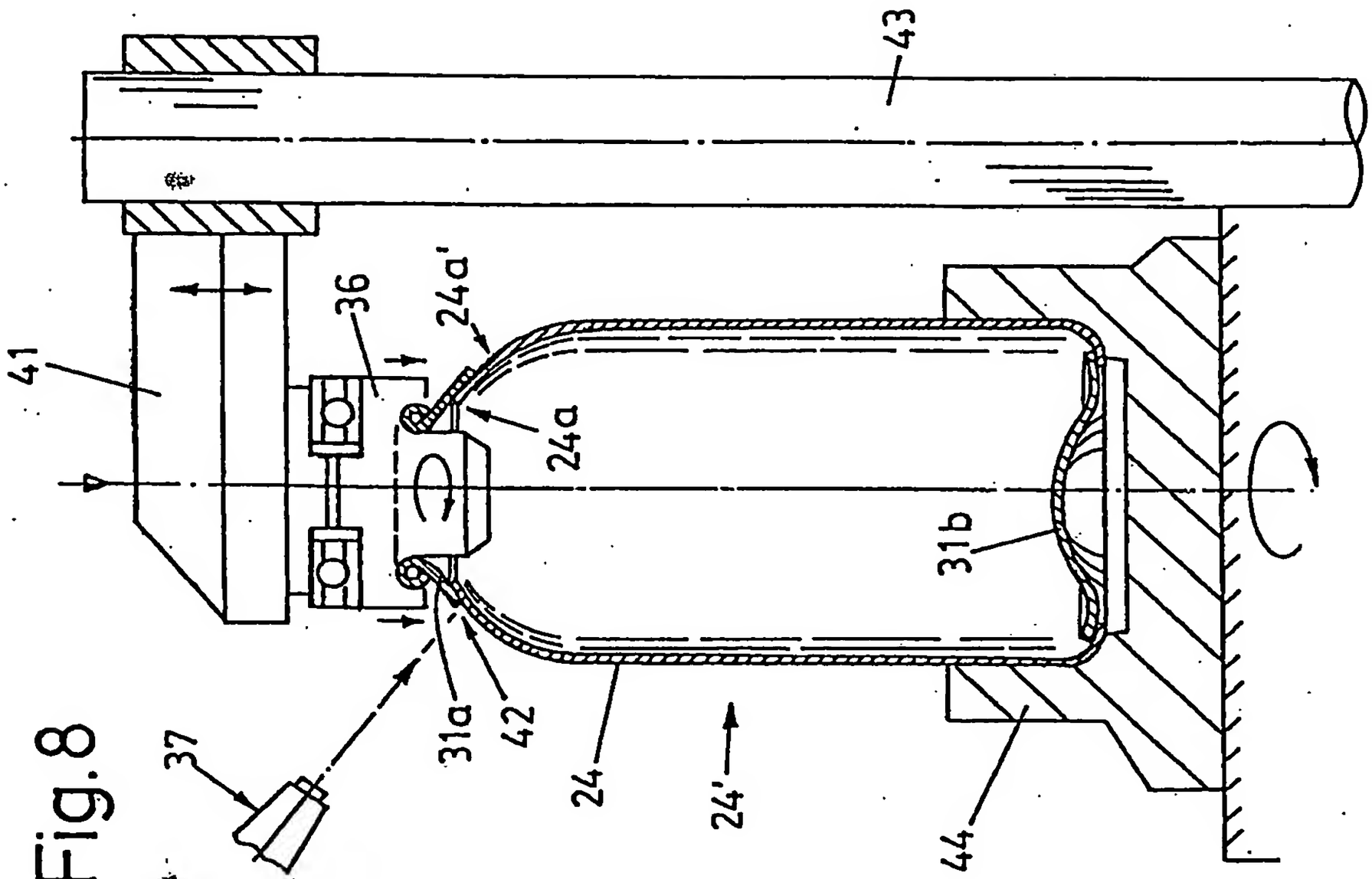


Fig.8

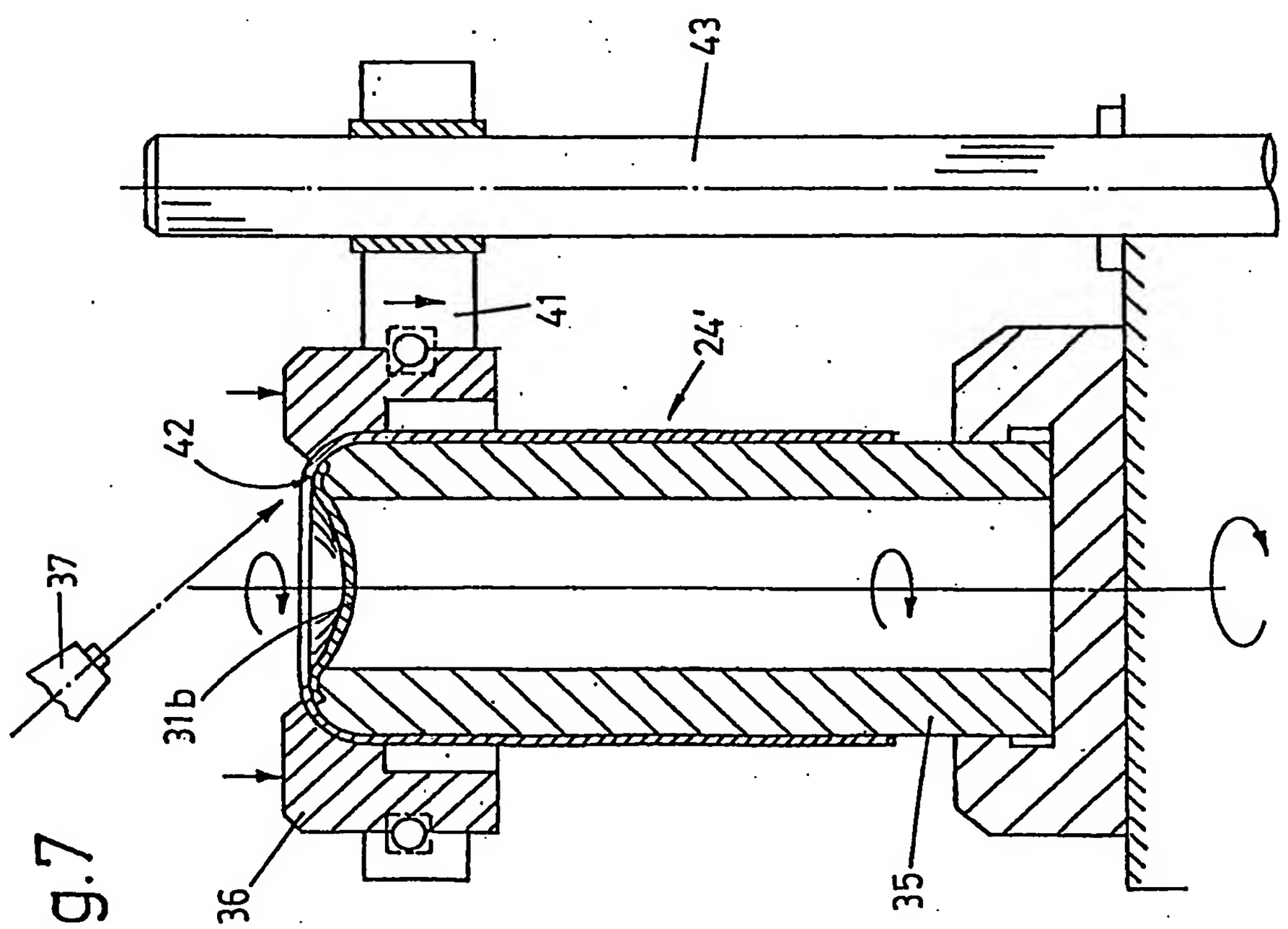


Fig.7

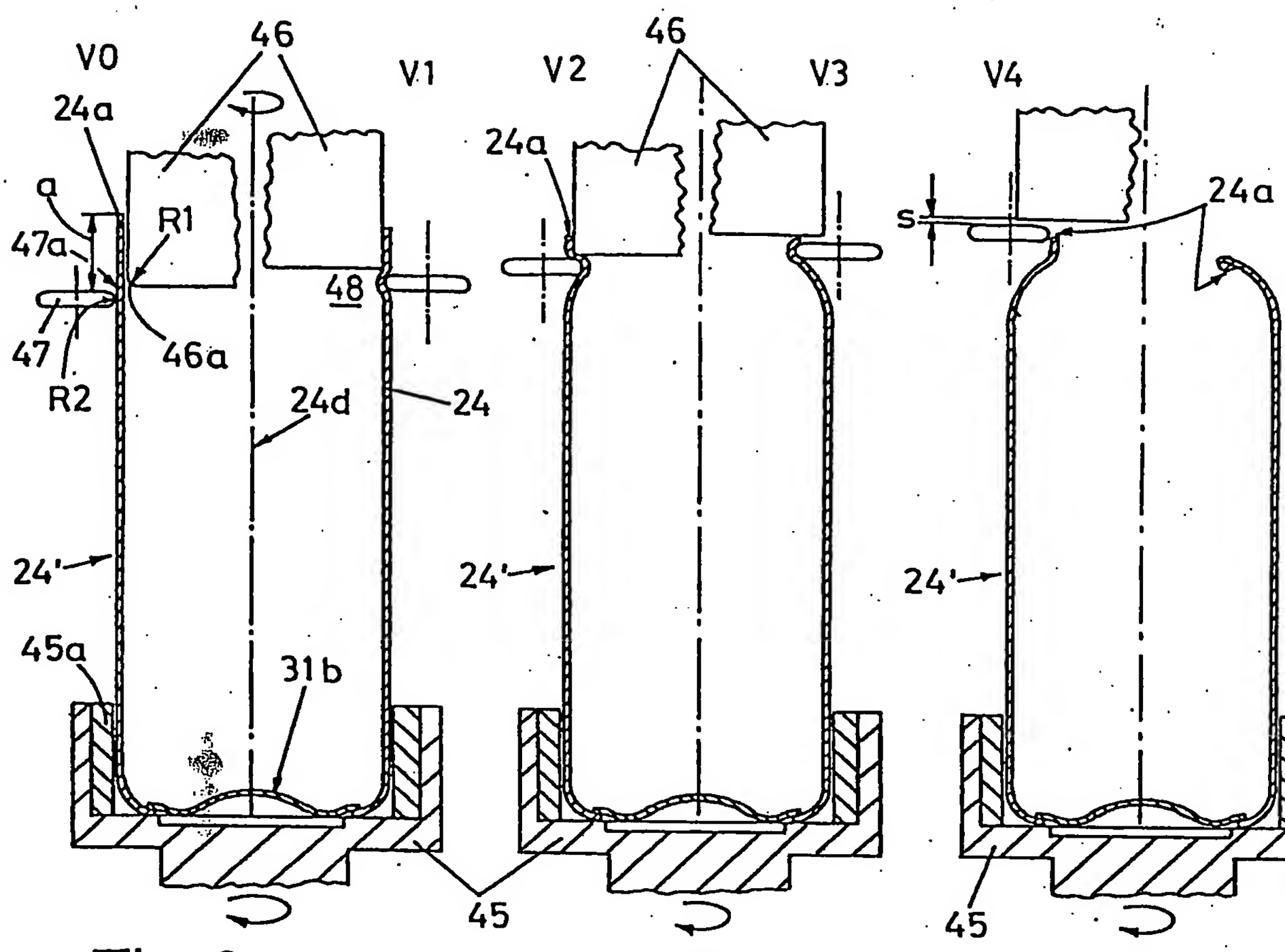


Fig.9a Fig.9b Fig.9c

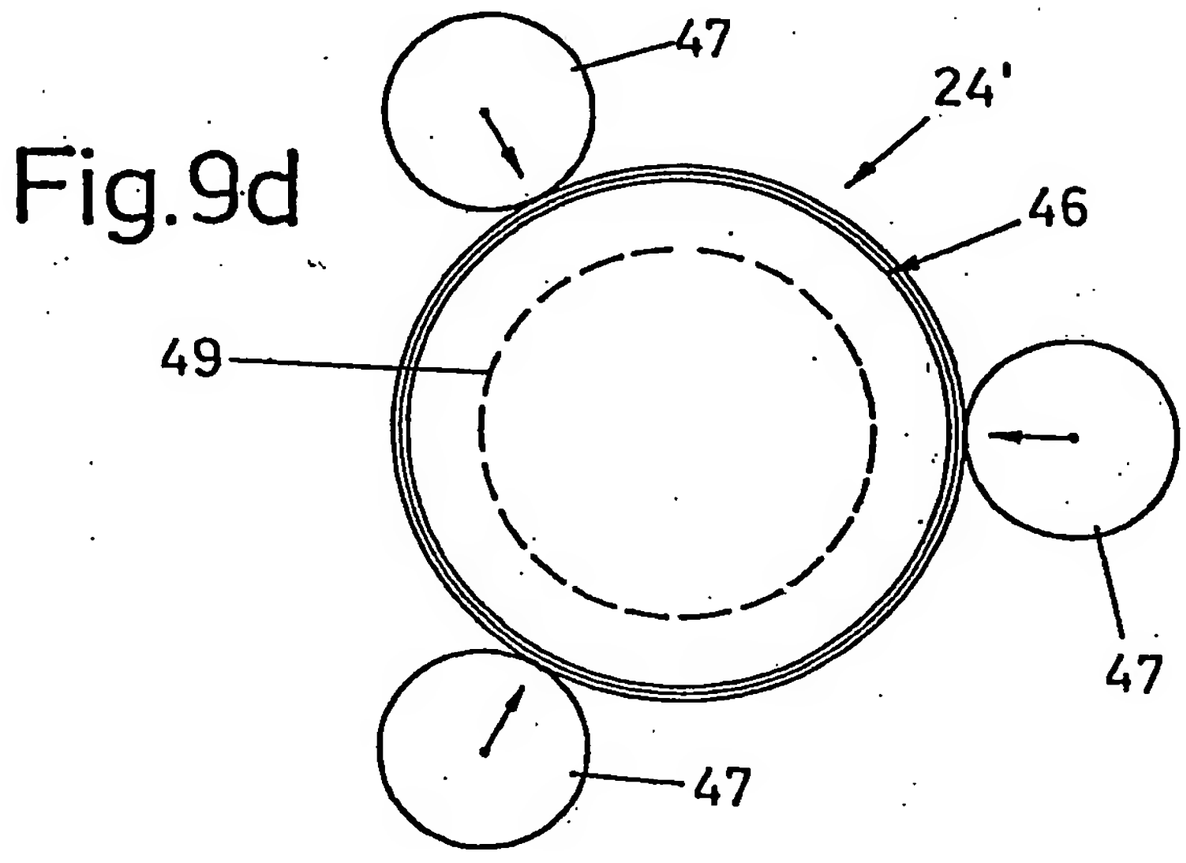


Fig.9d

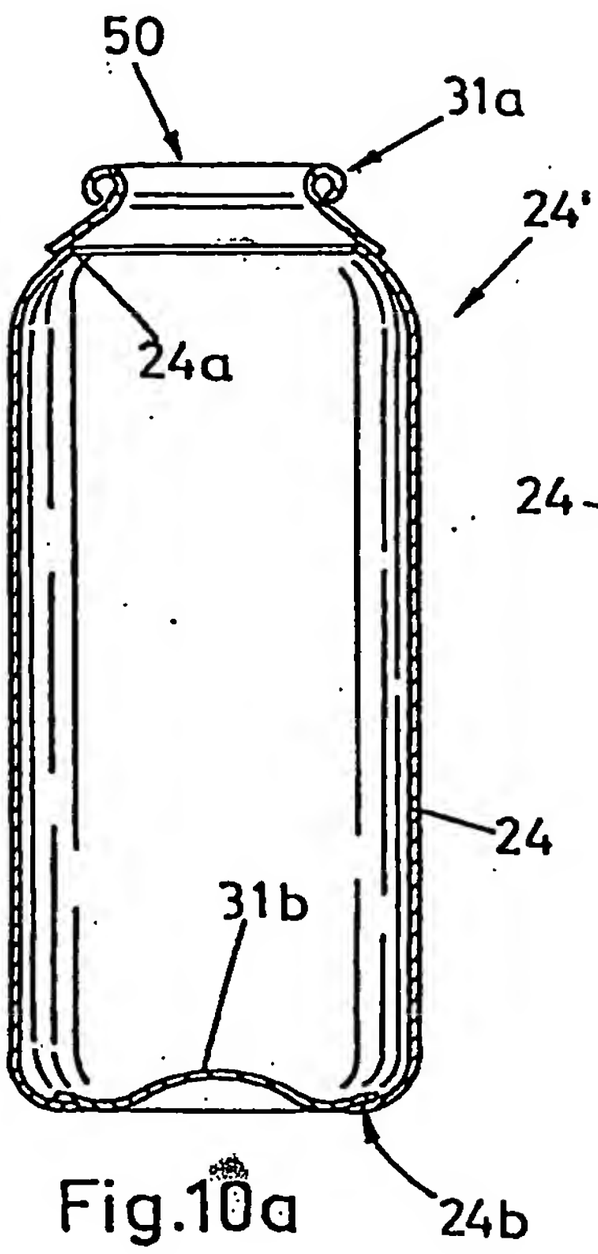


Fig.10a

Fig.10b

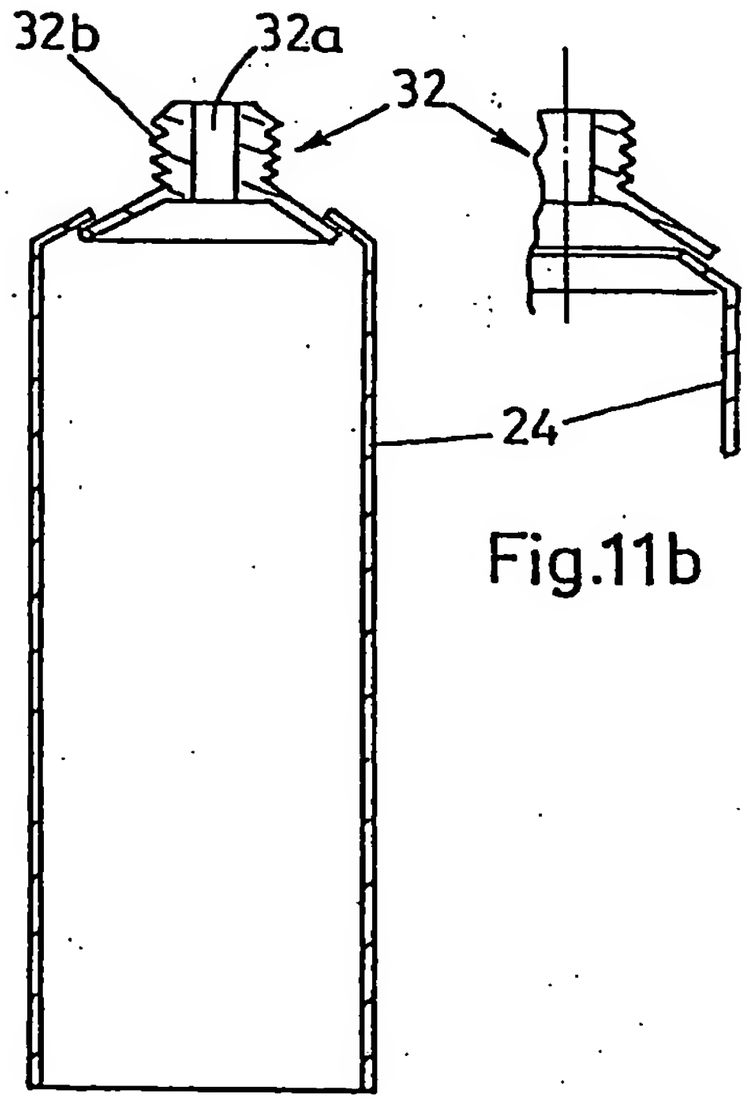


Fig.11b

Fig.11a

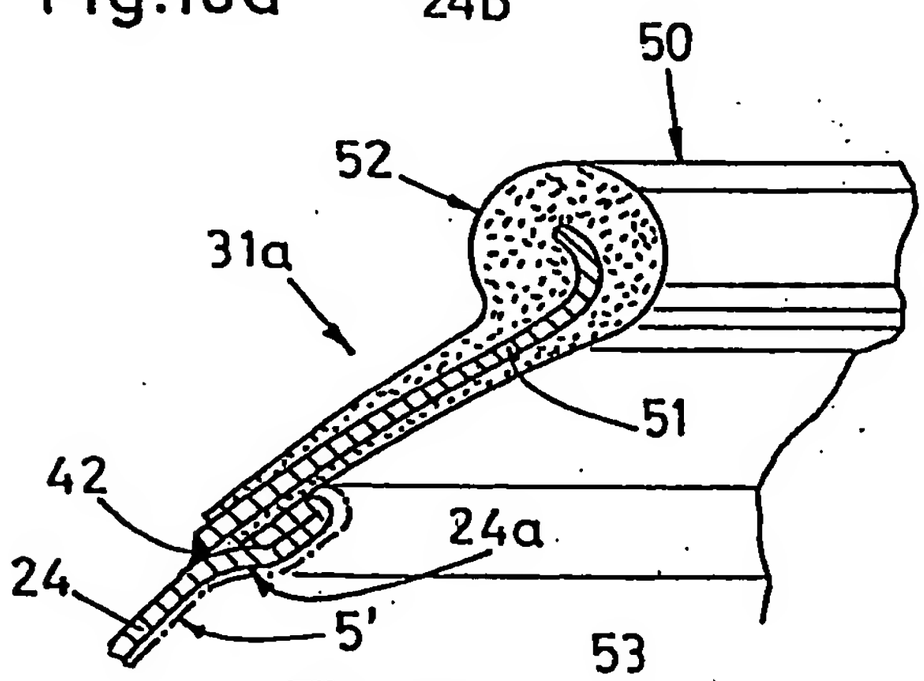


Fig.12

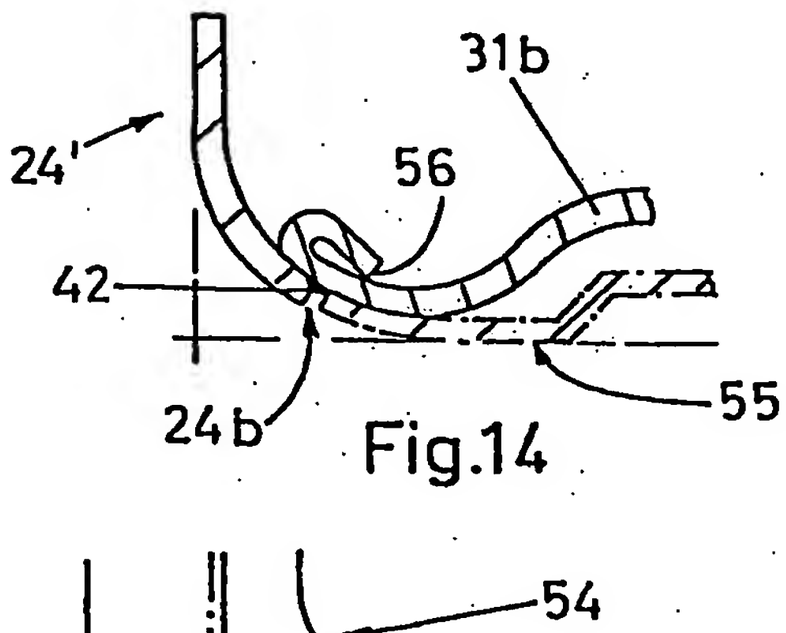


Fig.14

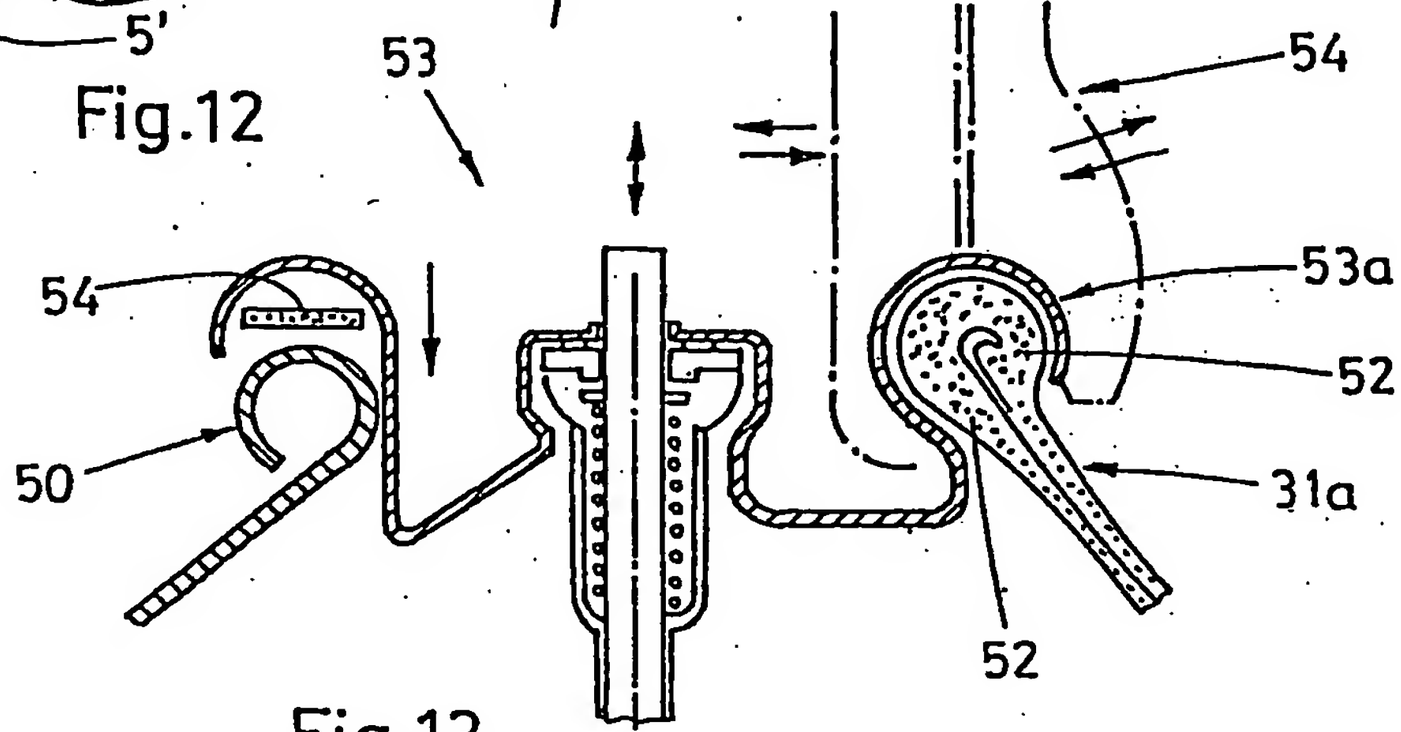


Fig.13

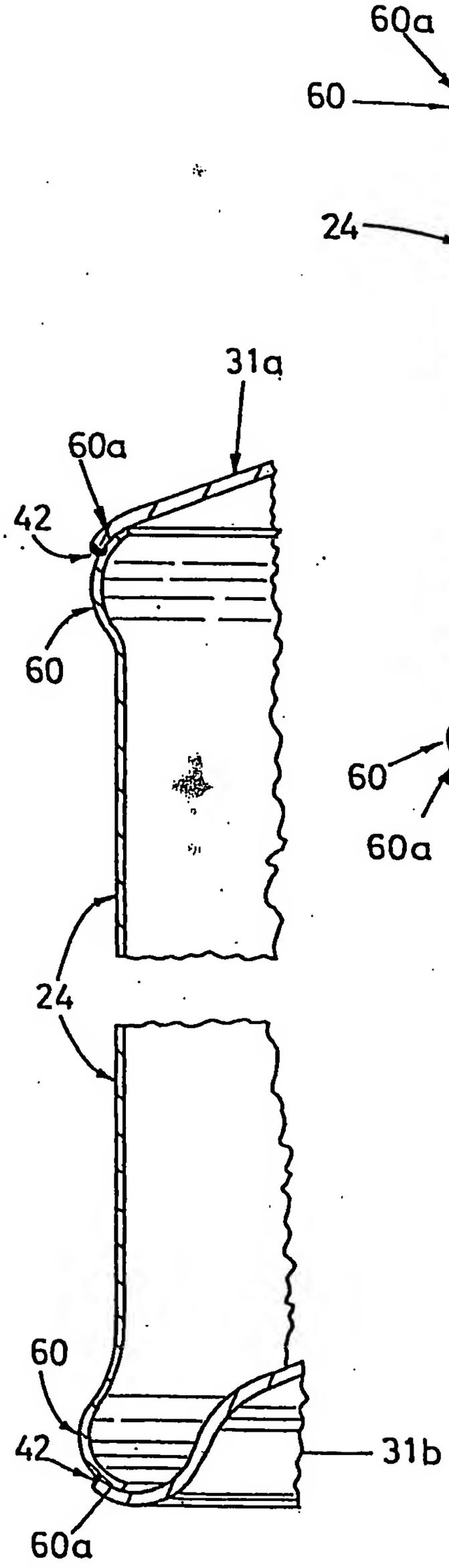


Fig.15b

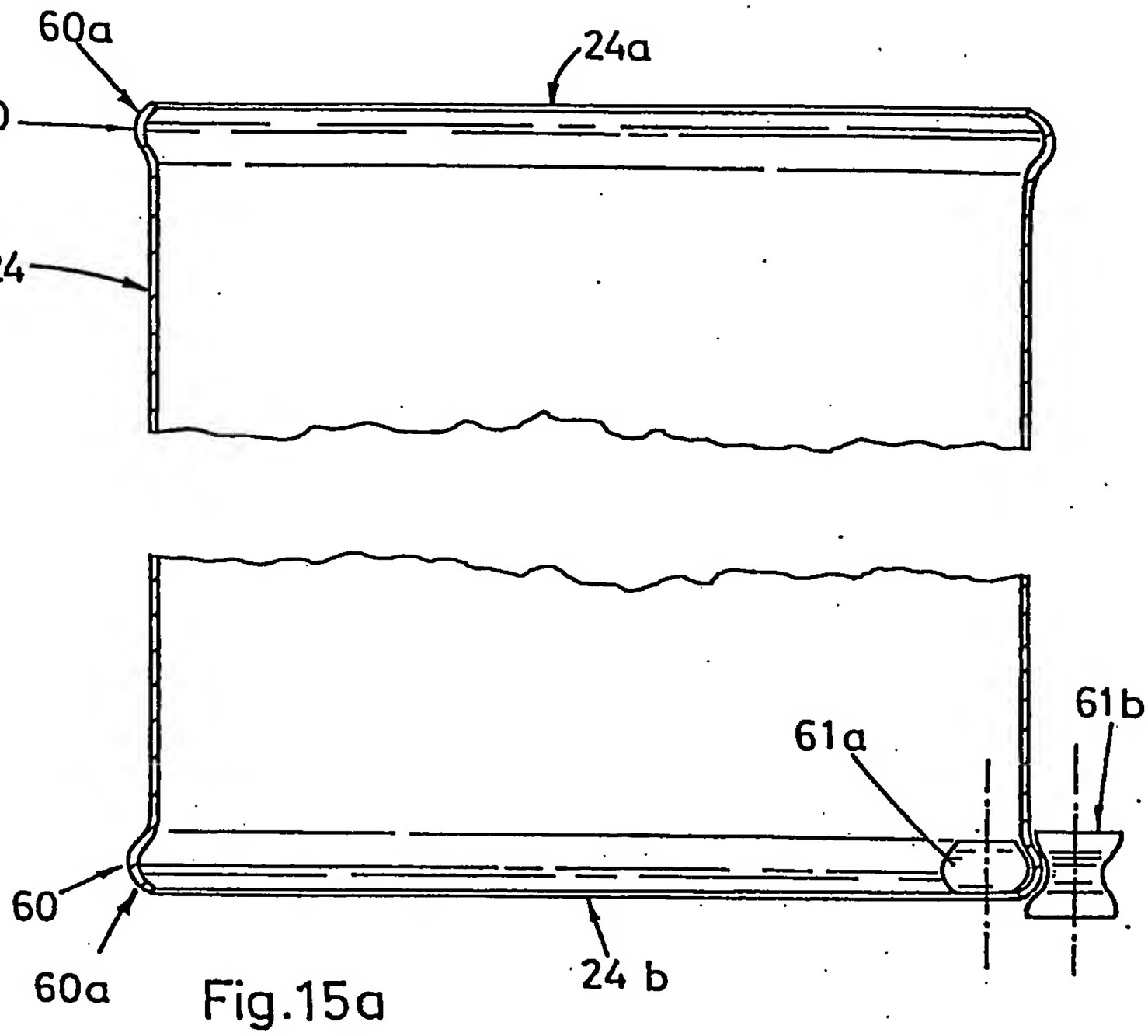


Fig.15a

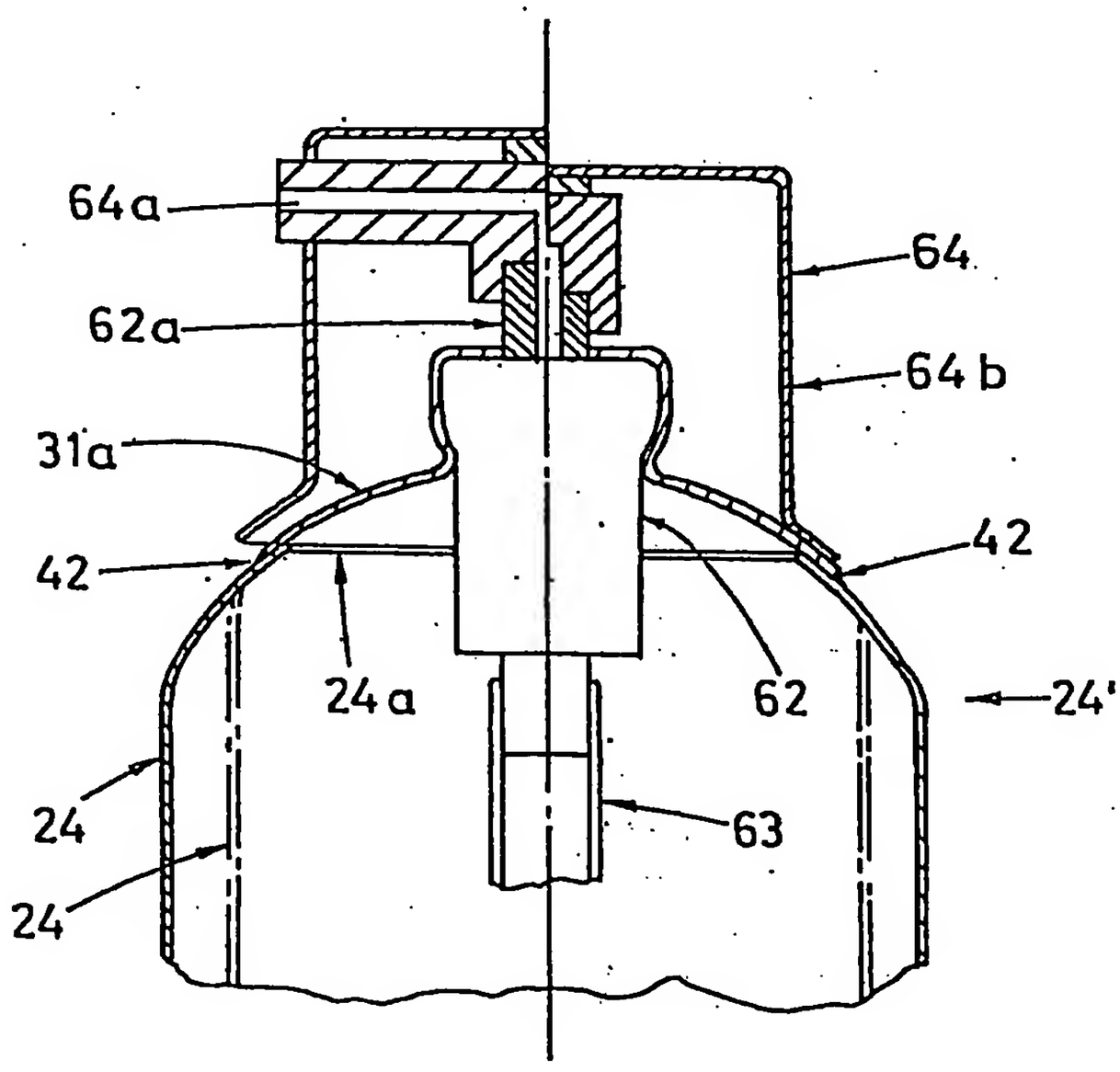


Fig.17

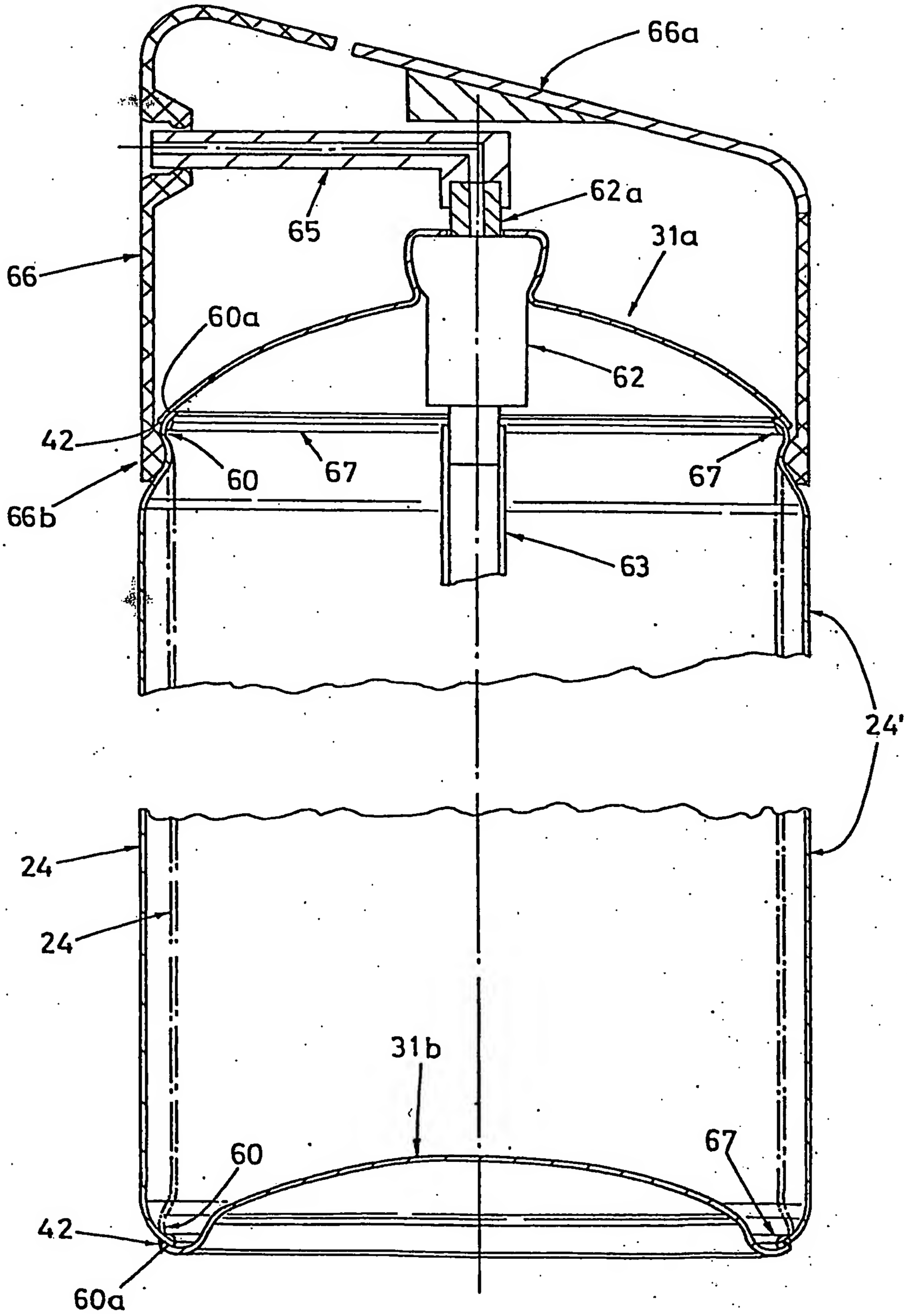


Fig.16

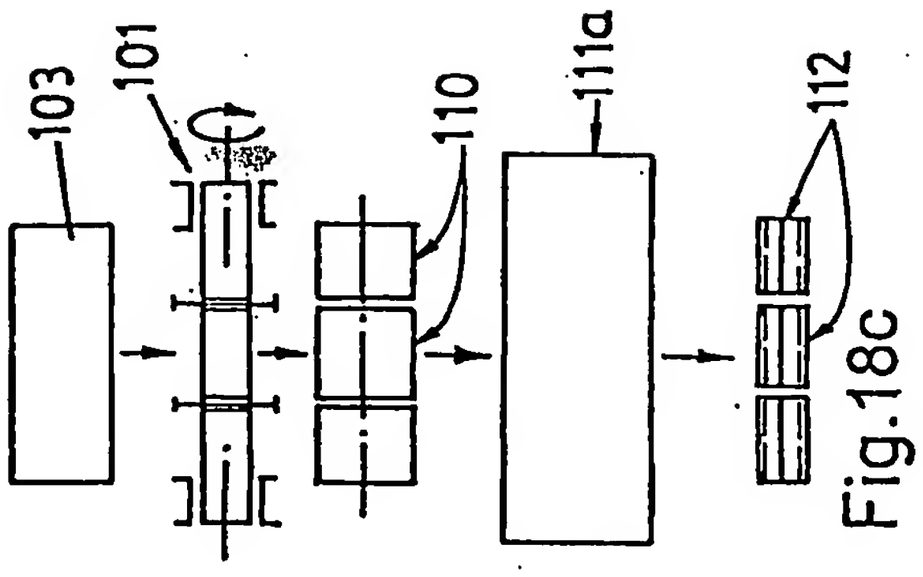


Fig.18c

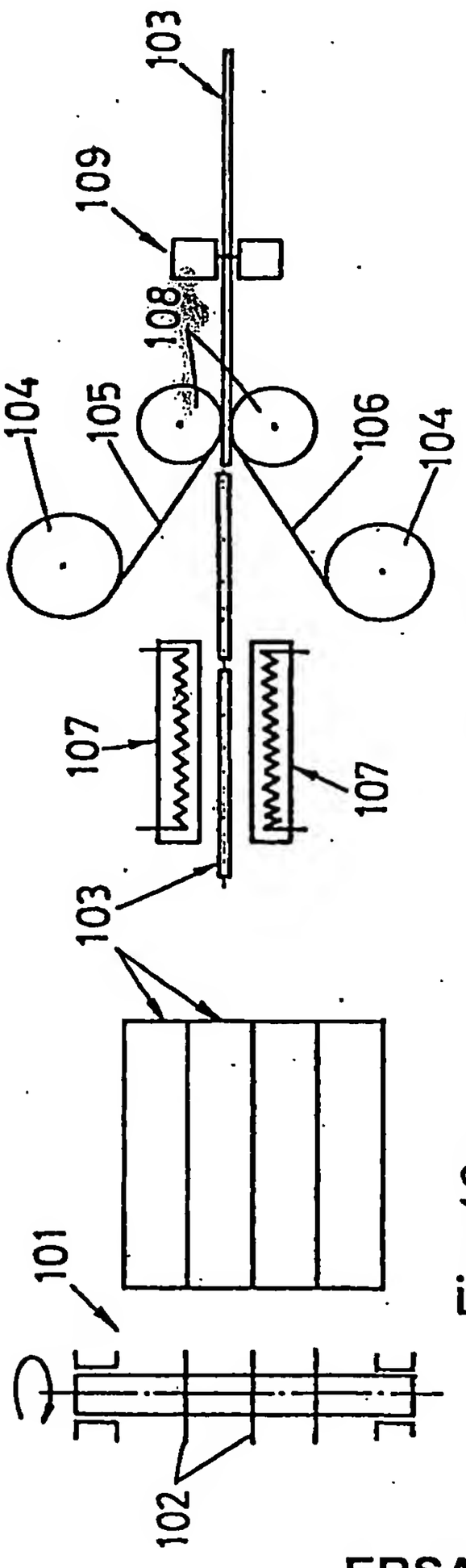


Fig.18b

Fig.18a

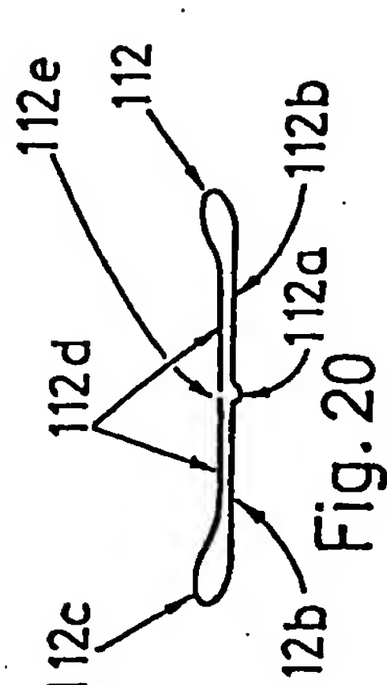


Fig. 20

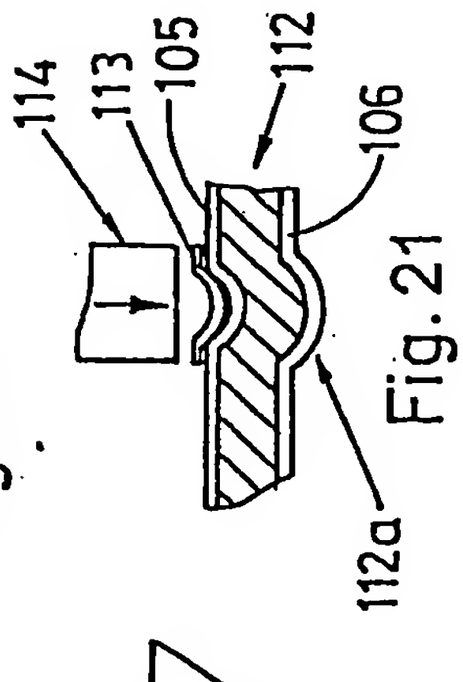


Fig. 21

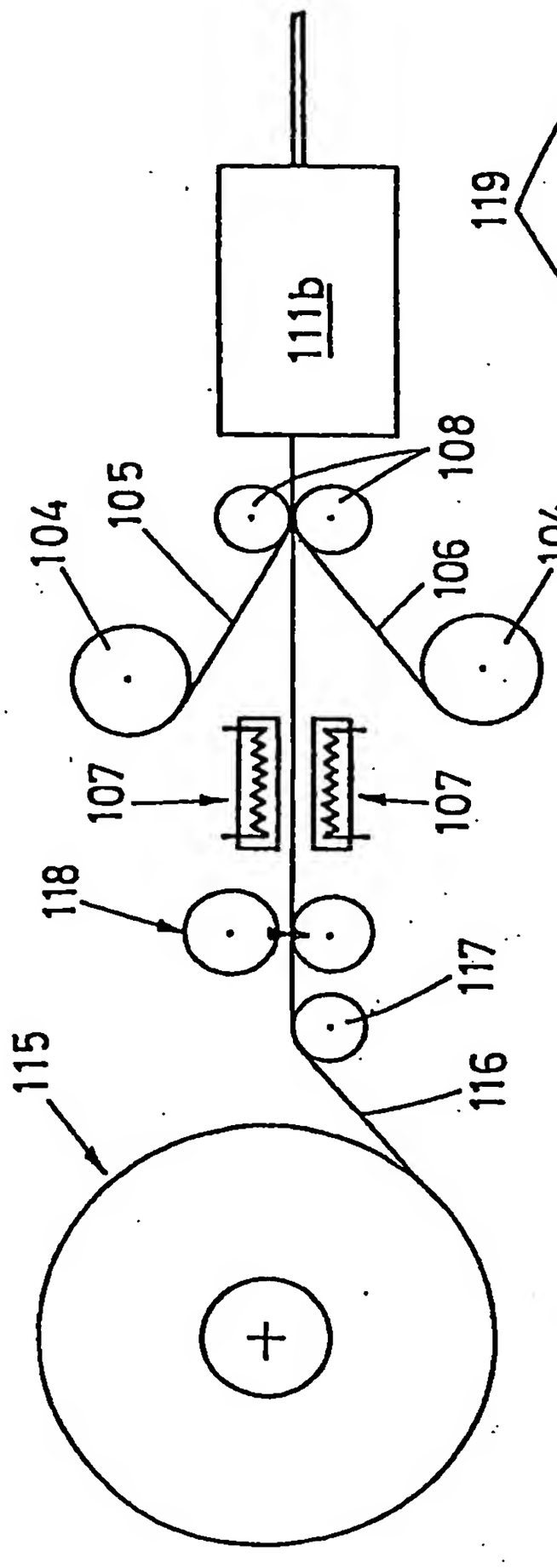


Fig.19

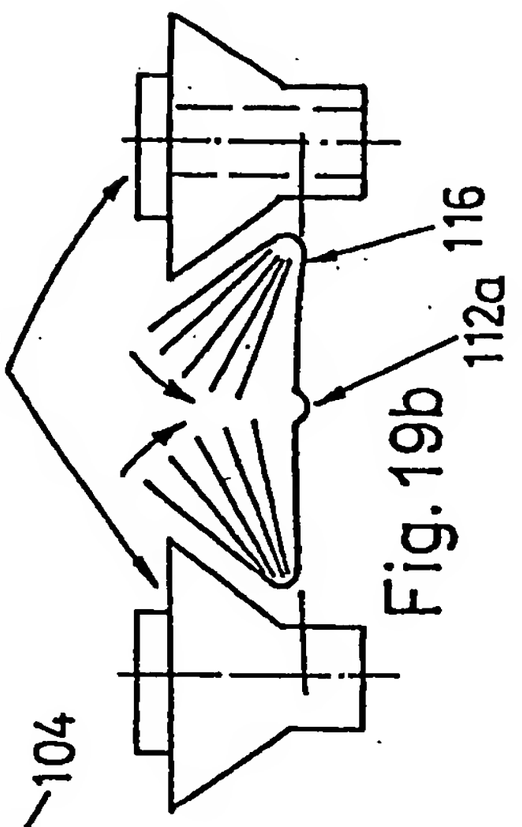


Fig.19b

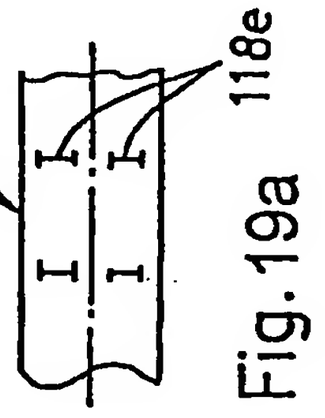


Fig.19a

Fig.18d

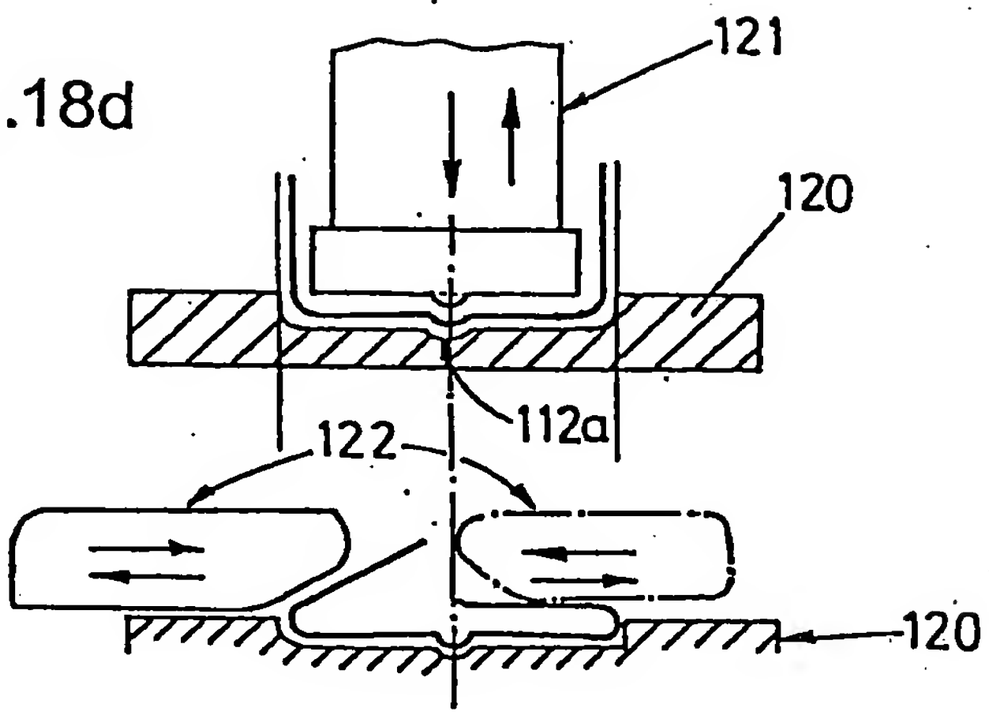


Fig.22

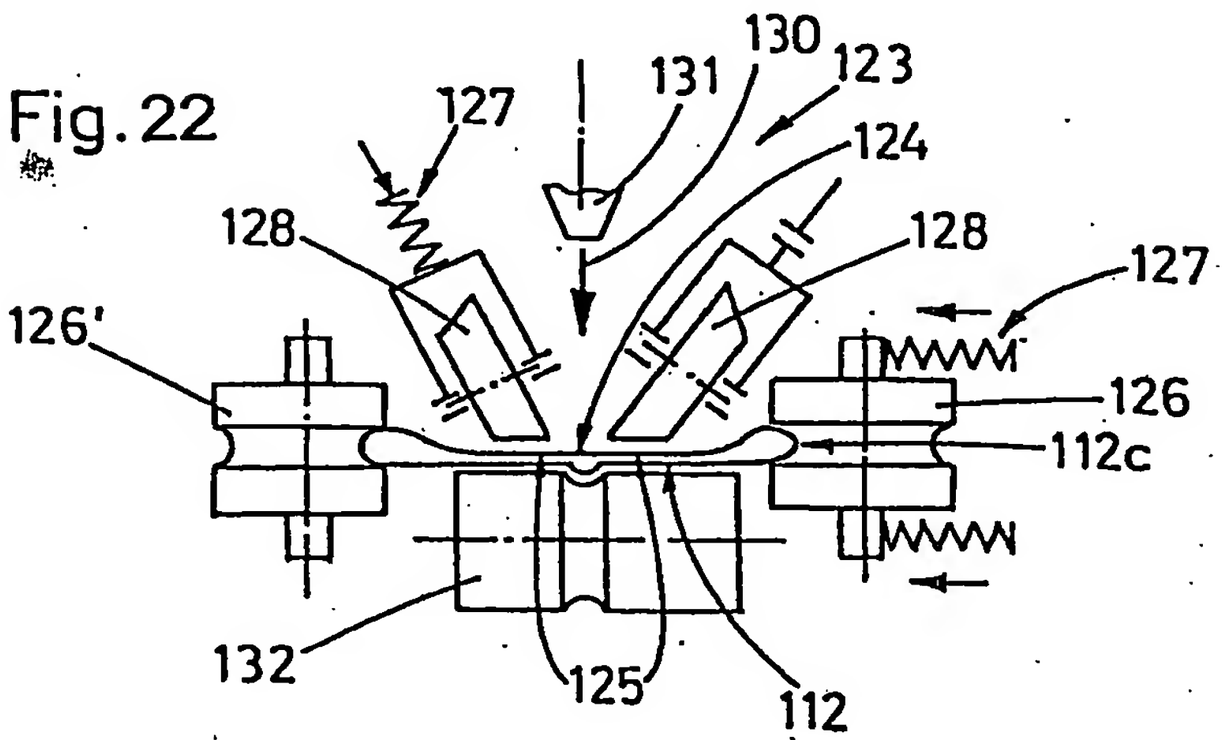
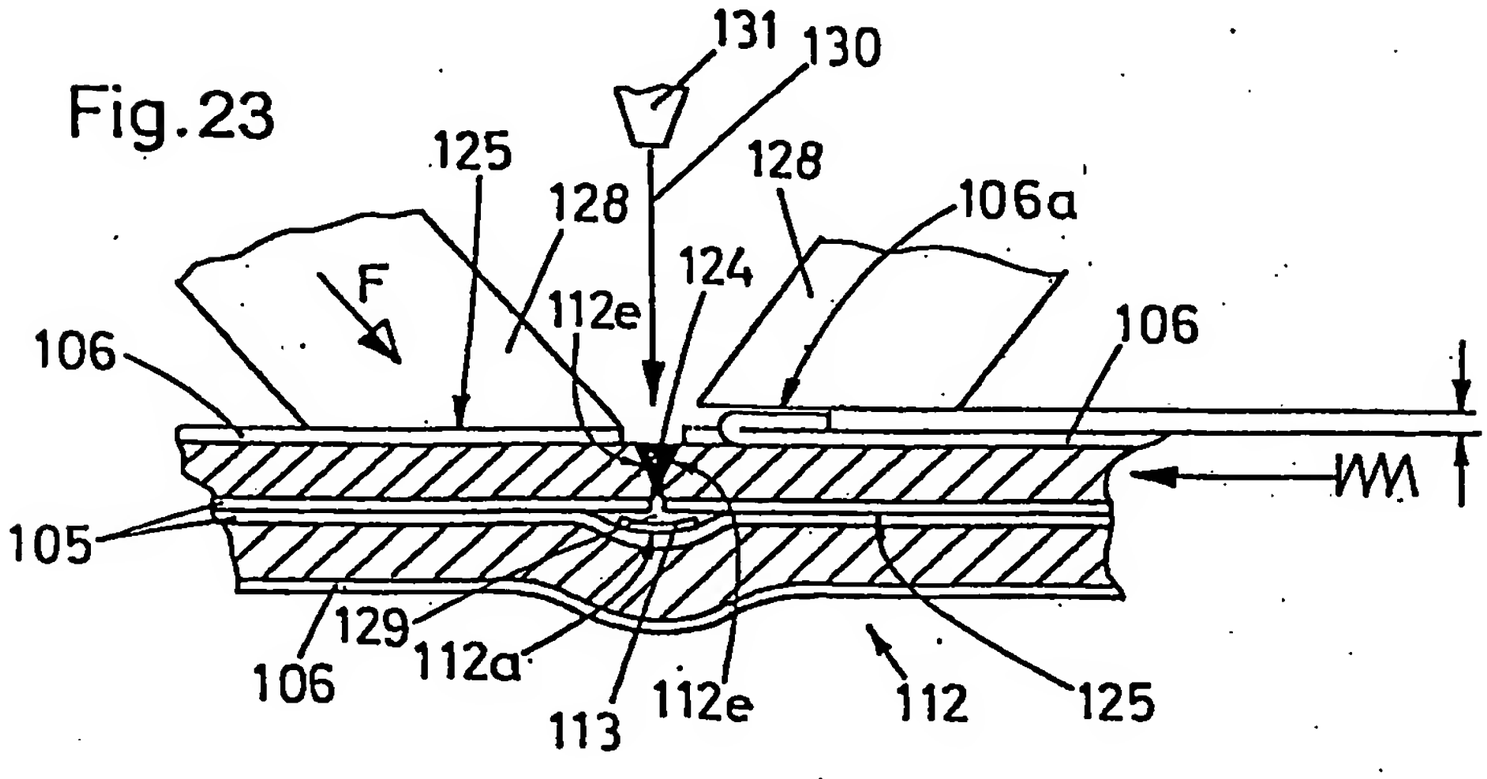


Fig.23



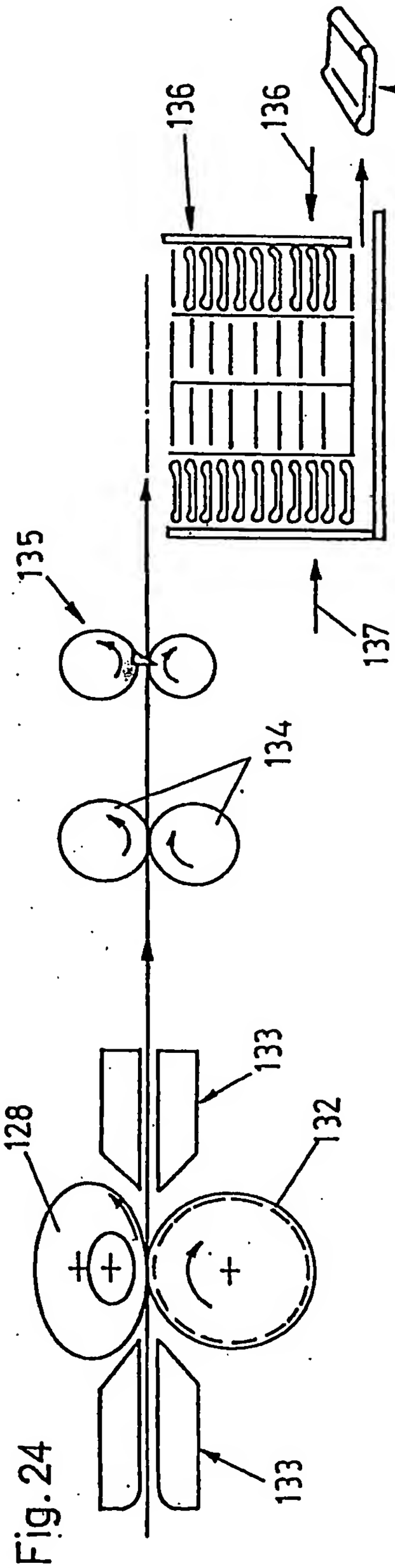

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Fig.24

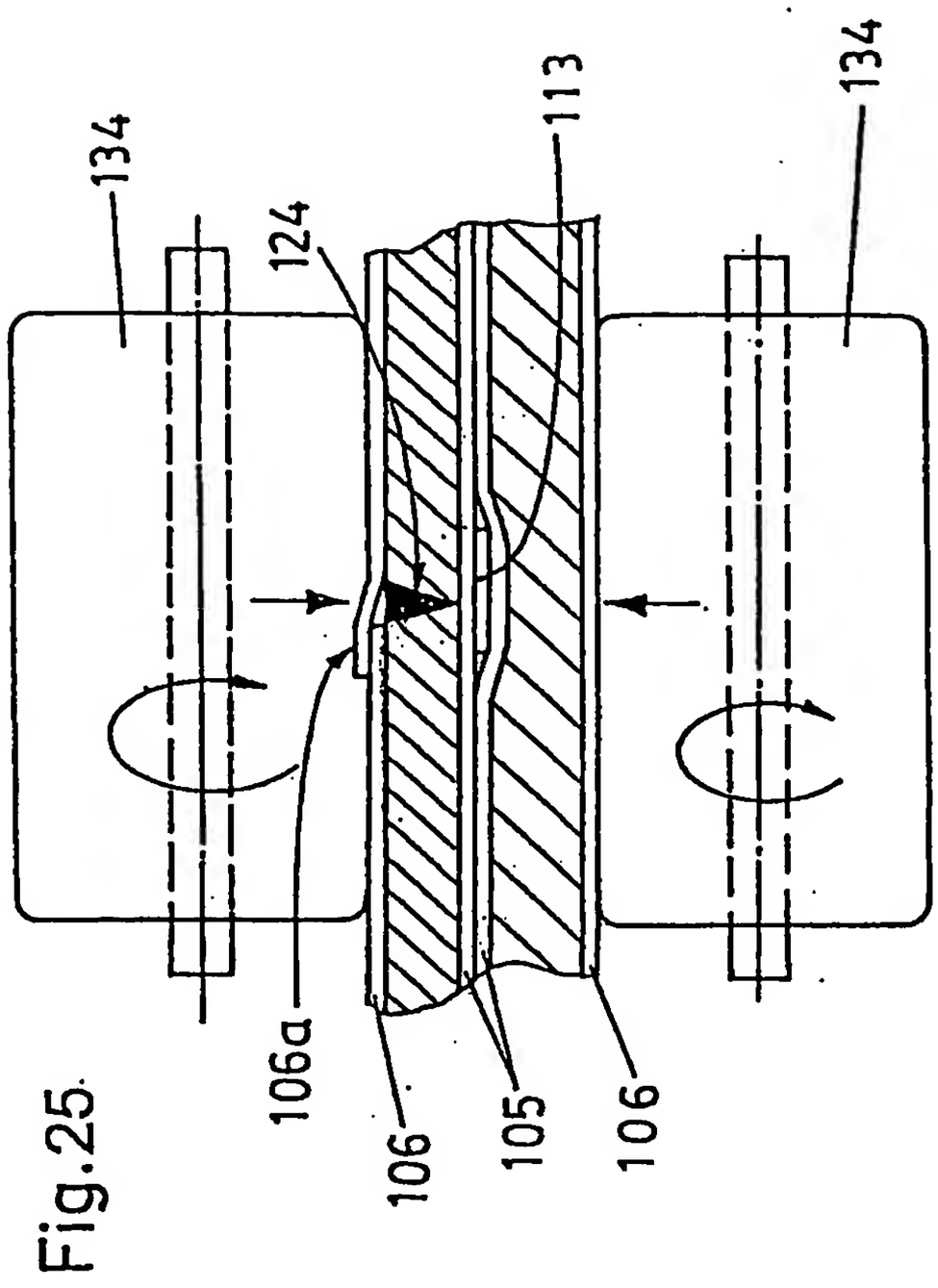
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Fig.25